Stress and sickness absence

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Prediction and causal mechanisms of mental sickness absence

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VRIJE UNIVERSITEIT

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Het leven van een mens is wat zijn gedachten ervan maken.
Marcus Aurelius

Aan Lisanne, Heleen en Marjolein

Colophon

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Contents

Chapter 1

General introduction

The importance of developing a prediction model for mental LTSA

Mental disorders are the leading cause of sickness absence and disability pensions in European countries [1]. The amount of workers with long term sickness absence (LTSA) due to mental disorders, including depression, anxiety, burnout and adjustment disorders, has increased over the past decade and is still increasing [2, 3]. The costs of sickness absence due to mental disorders is estimated at 3 – 4% of country's gross national product [4]. In the last five years mental disorders have accounted for an increasing proportion of LTSA in the Netherlands from 26% in 2015 to 40% in 2020 (Table 1).

Table 1 Causes of long-term sickness absence (%) in 2015-2018.
Source: HumanTotalCare, 2020

Year	Musculoskeletal disorders %	Other physical disorders %	Mental disorders %
2015	30	44	26
2016	30	40	29
2017	31	34	34
2018	30	33	36
2019	28	31	40
2020	26	34	40

Also the duration of mental sickness absence has increased. In 2020 the mean duration of mental sickness absence was 231 days compared to 186 days in 2015. The probability of resuming work decreases with increasing sickness absence duration [5,6]. In addition, poor knowledge about mental disorders can raise doubts in how to support workers with mental disorders and/or result in prejudices and negative attitudes with stigmatization and discrimination [7]. These doubts, stigmatization and discrimination can lead to feelings of shame prolonging the duration of mental LTSA [8]. A substantial proportion of the workers with mental LTSA did not (fully) return to work and was granted disability pensions after two years of sickness absence (Table 2).

Table 2 New disability pensions per diagnoses per age or through the years.
Source: National Social Security Institute (UWV), 2019 [9]

Cause of disease	2015	2016	2017	2018
Mental disorder	9.018 (28%)	10.035 (28%)	10.767 (28%)	11.267 (28%)
Musculoskeletal disorders	5.825 (18%)	6.611 (18%)	7.003 (18%)	6.944 (17%)
Cardiovascular diseases	2.415 (7%)	2.707 (8%)	2.993 (8%)	2.906 (7%)
Malignancies	3.184 (10%)	3.355 (9%)	3.480 (9%)	3.741 (9%)
Other diagnoses (Incl.unknown)	12.037 (37%)	13.378 (37%)	14.704 (37%)	15.272 (38%)
Number of new disability pensions	32.479 (100%)	36.086 (100%)	38.947 (100%)	40.130 (100%)

Approximately one third of the disability claims in the Netherlands as well as in other western countries is caused by mental disorders [1, 9].

Given the significant burden for individuals, companies, and societies, the Organization of Economic Cooperation and Development (OECD) pleaded that mental disorders should be a priority for stakeholders in the workplace [10]. We need more knowledge of predictors of mental sickness absence to identify those workers at high risk of mental LTSA before they report sick. In public health, prediction models are used to predict future health outcomes (e.g., LTSA). In the development of a prediction model it is determined which combination of variables best predicts the outcome. Recently, LTSA prediction models have been developed and validated for the Danish and Finnish working population. To our knowledge, prediction models are not yet developed and validated specifically for mental LTSA. In this thesis, prediction models for mental LTSA will be developed and validated using variables that are commonly addressed in occupational health surveys. This facilitates the implementation of the prediction models in occupational health care practice.

Occupational health care practice in The Netherlands

Occupational Health Surveys

According to the Dutch Labor Law, companies have to enable their employees to participate in an occupational health survey once every four years. Occupational health surveys are conducted by occupational health services (OHS) and consist of an online occupational health questionnaire. The questionnaire commonly addresses physical and mental workload, psychosocial work environment, working conditions and health complaints. For the rest, the content of the occupational health questionnaire varies amongst companies. For example, some companies may want to address social relations at work and management styles, while others address vitality and lifestyle factors in the occupational health survey. The OHS advises about the preferred variables in the occupational health survey questionnaire, based on a health and safety risk evaluation of the company. Management, staff representatives and work council decide about the definitive content of the questionnaire.

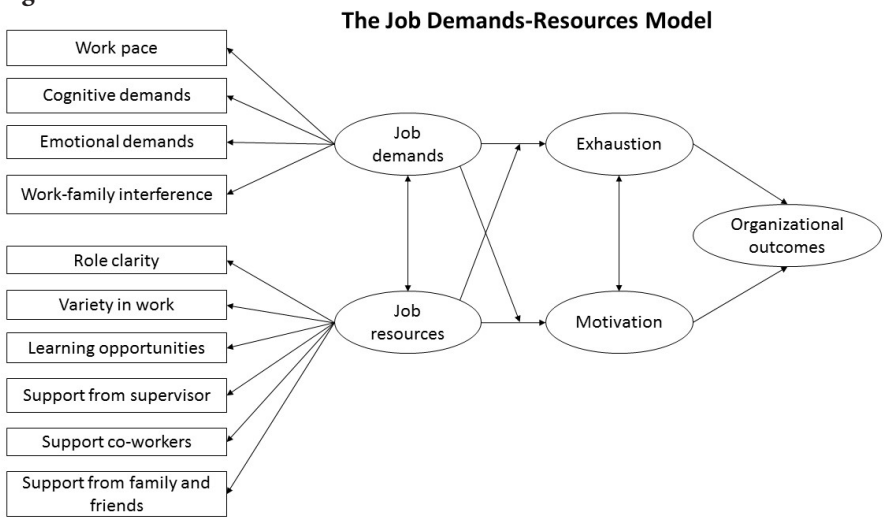
The OHS collects and analyzes the occupational health questionnaire results. Survey participants receive an individual feedback. At the request of trade organizations, companies or staff representatives, survey participants can consult with OHS professionals to discuss their questionnaire results, explore work and health risk factors and get an advice how to reduce risk factors. Companies receive a survey report presenting the results at team/ department level.

In The Netherlands sickness absence is financially compensated by the employer if medically certified by an occupational physician (OP) within 42 days of reporting sick. Consequently LTSA was defined throughout this thesis as sickness absence lasting ≥ 42 consecutive days. OPs certify sickness absence with a diagnostic code derived from the 10th International Classification of Disease (ICD-10). LTSA certified with a diagnostic code within the ICD-10 chapter V (Mental and Behavioral Disorders) was defined as mental LTSA, the outcome of the studies in this thesis. Sickness absence data were retrieved from the sickness absence register of a large Dutch OHS (HumanTotalCare). This OHS records the sickness absence data of approximately 1.5 million workers in 65,000 contracted companies from the first day of sickness absence to the day of full return to work, i.e.: at equal earnings as before sickness absence.

Causal mechanisms of mental LTSA

With more knowledge of causal mechanisms it is possible to improve the work environment in order to reduce the risk of mental LTSA. This thesis is based on the Job Demands-Resources (JD-R) model (figure 1) which distinguishes between job demands (i.e., those factors of a job that require physical or mental effort) and job resources (those aspects of a job that help to cope with job demands). The JD-R model describes an exhaustion process if the efforts to meet job demands are too high or if there is insufficient time to recover from the job demands [11,12]. Alternatively, high job resources help to achieve goals and stimulate personal growth, herewith increasing work satisfaction, a process known as the motivational process [13,14].

Figure 1



Several studies have used the JD-R model as a framework for investigating the relationship between psychosocial work characteristics and LTSA. In a study of 3,092 Dutch home care workers, high physical, emotional, and psychological job demands, problems with planning, and unwanted intimacies or physical threatening by patients were related to long sickness absence duration [13]. Worker-reported skill discretion, decision authority, social support, professional development, coaching by supervisor, feedback about one's performance, and financial rewards were related to a high sickness absence frequency. In a study of 201 Dutch managers, Schaufeli et al. [15] reported that increasing workload, emotional demands, and work-home interference were associated with a longer duration of sickness absence. Decreasing social support, autonomy, opportunities to learn, and feedback about one's performance were associated with a higher frequency of sickness absence. Based on the JD-R model, Clausen et al [16] reported that high work pace, high quantitative demands, low influence at work, and poor leadership quality resulted in a higher LTSA risk among 39,408 Danish workers. These studies have related psychosocial working conditions to all-cause LTSA. Studies relating psychosocial working conditions specifically to mental LTSA are lacking.

Prospective variables

Mental health symptoms are most obvious to identify workers at risk of mental LTSA. Several studies have shown prospective associations of psychological distress [17,18], depressed mood [19-21] and fatigue with mental LTSA [19, 22-24]. However, associations do not tell us whether these mental health symptoms discriminate between workers at high and low risk of mental LTSA. Roelen et al [25] investigated the Four-Dimensional Symptom Questionnaire (4DSQ) as prognostic instrument to predict future mental LTSA in 1137 non-sicklisted Dutch office workers. They reported that the 4DSQ distress scale, but not the scales measuring depression, anxiety and somatization discriminated between workers with and without mental LTSA during 1-year follow up.

Objectives and outline thesis

The first aim of this thesis is to predict the risk of mental LTSA in non-sicklisted workers participating in occupational health surveys. In chapter 2 we describe the predictive performance of the Maslach Burnout Inventory and Utrecht Work Engagement Scale for identifying workers at increased risk of mental LTSA. The ability of mental health symptoms to identify workers at increased risk of mental LTSA is presented in chapter 3. In chapter 4, the ability of the 16-item distress scale to discriminate between workers with and without future mental LTSA is compared with discrimination by a three-item distress screener. Chapter 5 investigates which job demands and job resources are predictive of mental LTSA in nurses. Chapter 6 describes which psychosocial work characteristics are prospectively associated with mental LTSA.

The second aim of this thesis is to increase the understanding of the causal pathways of psychosocial working conditions, work satisfaction, work ability and health outcomes in terms of distress, burnout and engagement leading to mental LTSA by using mediation analyses (chapter 7).

The third and last aim is to develop and validate a prediction model for risk of mental LTSA. Chapter 8 describes the development and internal validation of multivariable prediction models for mental LTSA by using logistic regression analysis and decision tree analysis. The regression and decision tree prediction models are externally validated in a new sample of occupational health survey participants in chapter 9.

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Chapter 2

Can the Maslach Burnout Inventory and Utrecht Work Engagement Scale be used to screen for risk of long-term sickness absence

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Int Arch Occup Environ Health (2015)

Abstract

Objectives
To investigate the Maslach Burnout Inventory – General Survey (MBI–GS) and the Utrecht Work Engagement Scale (UWES) for their ability to identify non-sicklisted employees at increased risk of long-term sickness absence (LTSA).

Methods
One-year prospective cohort study including 4921 employees participating in occupational health surveys in the period 2008–2010. The MBI–GS and UWES were part of the health survey questionnaire and LTSA in the year following the health survey was retrieved from an occupational health register. Associations of baseline MBI–GS and UWES scores with LTSA during 1-year follow-up were stratified by the cause (mental, musculoskeletal, and other somatic illness) of LTSA. Discrimination was assessed by the area (AUC) under the receiver operating characteristic curve and considered practically useful for AUC≥0.75.

Results
During 1-year follow-up, 103 employees (2%) had LTSA due to mental (N=43), musculoskeletal (N=31), or other somatic (N=29) illness. MBI–GS scores were positively and UWES scores negatively associated with mental LTSA, but not musculoskeletal or other somatic LTSA. Discrimination between employees at high and low risk of mental LTSA was moderate: AUC=0.68 for the MBI–GS and AUC=0.70 for the UWES. Discrimination did not improve when the MBI–GS and UWES were used simultaneously.

Conclusion
The MBI–GS and UWES predicted future mental LTSA in non-sicklisted employees, but discrimination was not practically useful for identifying employees at high risk of LTSA. However, both instruments could be used to select employees for further assessment of mental LTSA risk.

Introduction

Chronic strain without physical and mental recovery drains an individual's energy and may eventually lead to burnout, a state characterized by exhaustion, cynicism, and lack of professional efficacy [1]. Originally described as a psychological condition occurring among employees working in human service jobs (e.g., healthcare and education), burnout has now been expanded to all professions and even to persons outside the labour market [2]. Still, most burnout studies are based on specific occupational groups, particularly in the healthcare sector where the prevalence of burnout is high (Mateen and Dorji 2009). It is difficult to compare burnout prevalences across occupations or countries because of differences in definition and measurement. The European Commision [4] surveyed mental health states in EU countries with the Eurobarometer, revealing that 55% of respondents had lots of energy most of the time, 27% sometimes and 18% rarely or never. Thus, a substantial number of EU employees experience reduced energy levels, although this may not necessarily imply having burnout. The estimated prevalence of burnout in The Netherlands has increased from 11% In 2007 to 13% in 2013 [5].

Some employees with burnout report sick, while others stay at work. On the one hand, sickness absence may be a last resort to recover from work overload, thus preventing further energy depletion. On the other hand, it may be more and more difficult for employees with burnout to achieve work goals, which could aggravate feelings of inefficacy and ultimately lead to sickness absence [6,7]. In a cross-sectional population-based study, sickness absence was more prevalent in Finnish employees with burnout than in those without burnout [8]. Several prospective studies have reported relations between burnout and sickness absence. Baseline burnout levels were found to increase the number of sickness absence spells in Finnish industrial workers [9] and Danish human service workers [10]. In Sweden, burnout was found to be prospectively associated with long-term sickness absence in healthcare [11] and public service [12].

As mental disorders are negatively valued and stigmatized [13-15], burnout may be underreported. Probably, underreporting is less of a problem for positive psychological states emerging from the theory of positive psychology [16,17]. Work engagement is an example of such a positive work-related psychological state, characterized by high energy levels and dedication to work [18]. Originally, burnout and work engagement were considered counterparts [19]. While cynicism and dedication are each other's opposites, exhaustion and vigor are not [20,21]. Hence, burnout and work engagement are now regarded as distinct, yet closely related concepts. If higher burnout levels are related to an increased risk of sickness absence, then higher levels of work engagement could be associated with a reduced risk of future sickness absence.

In The Netherlands, the annual costs of sickness absence amount to €7.2 billion of which €2.7 billion is related to mental illness [22]. Taimela et al. [23] and Kant et al. [24] found that preventive consultations reduced the number of sickness absence days. Such consultations might also reduce or prevent LTSA episodes, but then we have to know which employees are at risk of LTSA. As burnout is an increasing cause of LTSA, the objective of the present study was to assess the case-finding ability (i.e., the ability to identify non-sick-listed employees at risk of future LTSA) of the instrument used for measuring burnout in occupational healthcare. To bypass potential underreporting of burnout, we also investigated the instrument to measure work engagement for its LTSA case-finding ability.

Methods

Study settings and design

ArboNed is a Dutch national occupational health service (OHS) that provides occupational health care to 1.1 million employees of more than 70,000 contracted companies (75% small businesses and 25% (multi)national corporations) in the agricultural (7%), industrial (23%), private (40%), and public (30%) sectors. Besides the registration of sickness absence and guidance of sick-listed employees back to work, the surveillance of work and health is an important OHS task in The Netherlands. According to Dutch law, employers are obliged to offer a health survey to their personnel every four years, although participation in health surveys if not compulsory for employees. ArboNed provides different types of health surveys ranging from brief check-ups to extended health checks with physical examinations and blood tests. Employers decide on the type of health survey in dialogue with the works council or employee representatives.

In the period 2008–2010, ArboNed invited a total of 7480 employees by order of 58 contracted companies for a 'vitality check'. This type of health survey consists of an extended questionnaire about physical and mental health, lifestyle, coping behaviours, well-being, personality and resources (self-efficacy, resilience, hope, and optimism), work ability, job demands, job resources (e.g., autonomy, support, feedback), job satisfaction and motivation, leadership, and work–home interference. A total of 4921 (66%) employees completed the vitality check questionnaire online and received a personal report and advice based on the questionnaire results.

The vitality check questionnaire contains instruments to measure burnout and work engagement. The scores on these instruments were associated with LTSA retrieved from the ArboNed sickness absence register in the year following the vitality check. Ethical clearance for this prospective cohort study was granted by the Medical Ethics Committee of the University Medical Center Groningen (reference M12.116654).

Maslach Burnout Inventory – General Survey (MBI–GS)

The Dutch version of the MBI–GS contains 15 items measuring exhaustion, cynicism, and personal efficacy with good psychometric properties [25]. The exhaustion scale consists of 5 items (Cronbach's α=0.86) about feeling emotionally overextended and exhausted by work. The cynicism scale contains 4 items (α=0.76) about disengagement from work and lack of enthusiasm. All items were scored on a frequency scale, ranging from 0 'never' to 6 'always'. Item scores were summed to scale scores 0–30 and 0–24, with higher scores representing more exhaustion and cynicism, respectively. There is cumulating evidence that lack of professional efficacy plays a divergent role as compared to exhaustion and cynicism [26]. Hence, we decided to exclude the 6-item (α=0.76) professional efficacy scale from our analyses. Consequently, a total MBI–GS score was calculated by summing the scores on exhaustion and cynicism. The total MBI–GS score was standardized as percentage of the maximum score, and higher standardized scores (range 0–100) represent higher levels of burnout.

Utrecht Work Engagement Scale (UWES)

The UWES consists of 17-items measuring three aspects of work engagement: vigor (6 items; α=0.88), dedication to work (5 items; α=0.92), and absorption in work (6 items; α=0.77).

The UWES has been psychometrically validated for use in organizational settings [27]. UWES items were scored on a frequency scale, ranging from 0 'never' to 6 'always', and summed to scale scores 0–36, 0–30, and 0–36 with higher scores reflecting more vigor, dedication, and absorption, respectively. A total UWES score was calculated by summing all scores [28] and standardized as percentage of the maximum score. Higher standardized UWES scores (range 0–100) represent higher levels of work engagement.

Sickness absence

There is no international consensus on how to define LTSA. Sickness absence in The Netherlands is employer-compensated if it is medically certified by an occupational physician (OP) within 42 days of reporting sick [29]. Therefore, we defined LTSA as sickness absence episodes lasting ≥42 consecutive days. LTSA was medically certified with a diagnostic code of the 10th version of the International Classification of Diseases (ICD-10), which was recorded in the OHS register. At 1-year follow-up, LTSA was retrieved at the individual level from the register; if an employee had more than one LTSA episode during follow-up, then the first LTSA episode was used for analysis. Based on the OP-diagnosis, LTSA was stratified into mental (ICD-10 chapter F: Mental and Behavioural Disorders), musculoskeletal (ICD-10 chapter M: Musculoskeletal Disorders), and other somatic LTSA (remaining ICD-10 chapters).

Confounder analysis

Previously, Borritz et al. [10] analyzed the association between burnout and sickness absence controlling for a variety of sociodemographic, work-related, and health-related variables. Unfortunately, the authors did not investigate which variables acted as confounders. Furthermore, we know little about factors that might confound the association between UWES scores and LTSA. Therefore, we analyzed the confounding effect of sociodemographic and lifestyle variables obtained from the vitality check questionnaire. Job demands and job resources were not assessed as potential confounders as these variables play a role in the causal pathways to burnout and work engagement [6,7,30]. Work-related conflicts were also not assessed because we could not rule out the possibility that conflicts play a role in the pathway between burnout and sickness absence. After all, cynicism and lack of professional efficacy might provoke irritations and disturb relations at the workplace, ultimately leading to sickness absence.

Sociodemographic variables included age, gender (men, women), marital status (living with parents, alone, cohabiting, other), children at home (no, yes), employment (permanent, temporary), work hours/week, tenure in work and in the present job as well as gross monthly income (<€2000, €2000–2999, €3000–3999, €4000–4999, ≥€5000). Lifestyle variables included body mass index (BMI), physical activity, smoking habits, alcohol consumption, and the use of drugs and sedatives. BMI was calculated from employee-reported body length and weight. Leisure-time physical activity was assessed by two items about performing moderately straining daily activities (e.g., walking stairs, vacuum cleaning) for at least 30 consecutive minutes and practising sports for at least 20 consecutive minutes. Both items were rated on a frequency scale 'never', '1x/week', '3x/week', '5x/week', and 'daily'. Smoking and drinking alcohol were rated on frequency scales 'never', '1x/week', '3x/week', and 'daily'. The use of drugs was assessed by items on soft drugs (e.g., cannabis), hard drugs (e.g., heroin,

cocaine) and sedatives, rated on frequency scales 'never', '1x/week', '3x/week', and 'daily'. Finally, LTSA (no/yes) recorded in the OHS register in the year prior to the vitality check was tested as a potential confounder of the associations of MBI–GS and UWES scores with LTSA during 1-year follow-up. A total of 93 employees (2%) were shown to have had LTSA in the year prior to the vitality check: 35 (38%) due to mental, 28 (30%) musculoskeletal, and 30 (32%) other somatic illness.

In confounder analysis, we considered variables as confounders if the regression coefficients of MBI–GS and UWES scales changed ≥10% after adding the variable to regression analysis [31]. Table 1 shows that smoking habits and LTSA in the year prior to the health check potentially confounded the associations of MBI–GS and UWES scales with LTSA. Adding prior LTSA caused the greatest change in regression coefficients and was therefore the strongest confounder. When prior LTSA was included as covariate in regression analysis, smoking habits did not additionally affect the regression coefficients [data not shown], indicating that it sufficed to include prior LTSA as confounder in the analyses [31].

Table 1 Confounder analysis.
The table shows logistic regression coefficients of crude and adjusted associations with long-term (≥42 days) sickness absence (LTSA). If the regression coefficient changed ≥10%, the added variable was regarded as confounder [31].

		Maslach Burnout Inventory		Utrecht Work Engagement Scale		
		Exhaustion	Cynicism	Vigor	Dedication	Absorption
Crude		0.171	0.214	–0.076	–0.129	–0.108
Adjusted for	age	0.174	0.210	–0.082	–0.129	–0.106
	gender	0.174	0.219	–0.077	–0.134	–0.109
	education	0.171	0.214	–0.074	–0.129	–0.107
	marital status	0.174	0.214	–0.078	–0.129	–0.108
	children at home	0.170	0.213	–0.074	–0.128	–0.107
	income	0.167	0.211	–0.081	–0.130	–0.104
	employment	0.171	0.220	–0.102‡	–0.151‡	–0.114
	work hours	0.171	0.211	–0.072	–0.128	–0.105
	tenure in work	0.175	0.207	–0.085‡	–0.128	–0.106
	tenure in present job	0.169	0.215	–0.086‡	–0.133	–0.110
	body mass index	0.176	0.218	–0.076	–0.134	–0.108
	physical exercise	0.179	0.204	–0.071	–0.119	–0.102
	practice sports	0.177	0.214	–0.079	–0.121	–0.104
	smoking	0.132‡	0.199‡	–0.055‡	–0.116‡	–0.114
	drinking alcohol	0.171	0.214	–0.077	–0.132	–0.108
	using soft drugs	0.171	0.223	–0.076	–0.129	–0.110
	using hard drugs	0.171	0.214	–0.076	–0.129	–0.108
	using sedatives	0.176	0.232	–0.071	–0.123	–0.105
	prior LTSA	0.107‡	0.159‡	–0.043‡	–0.099‡	–0.062‡

‡ indicates confounding

The type of employment (permanent versus temporary) and tenure in both work and present job confounded the relationship between UWES scales and LTSA (Table 1). Adding the type of employment to regression models including UWES scales and prior LTSA, increased the regression coefficients of vigor and dedication by more than 10%. Neither tenure in work nor tenure in the present job additionally affected regression coefficients of these UWES scales [data not shown]. Hence, the analyses of associations between UWES and LTSA were controlled for prior LTSA and type of employment.

Statistical analysis

Statistical analyses were performed in IBM SPSS Statistics for Windows (version 20.0). The associations of MBI–GS scale scores and the total MBI–GS score with LTSA (no=0, yes=1) were investigated by logistic regression analyses, controlling for prior LTSA. Likewise, we investigated associations of UWES scale scores and the total UWES score with LTSA, controlling for prior LTSA and type of employment. Throughout the paper, we present adjusted odds ratios (OR) and related 95% confidence intervals (CI).

The ability of MBI–GS and UWES to discriminate between employees at high and low risk of LTSA was assessed by receiver operating characteristic (ROC) analysis. If we regard employees with LTSA as 'cases' and those without LTSA as 'non-cases', then we can calculate the sensitivity and specificity for each score of the MBI–GS or UWES. The ROC-curve plots sensitivity (i.e., true positive rate) against 1–specificity (i.e., false positive rate) for each possible MBI–GS or UWES score. The area under the ROC-curve (AUC) reflects the degree of discrimination, that is: the ability of MBI–GS or UWES to correctly classify employees as 'cases' or 'non-cases'. If we were to rely on pure chance, the ROC-curve would be a diagonal line and AUC=0.50. Generally, AUC≥0.75 is considered to reflect practically useful discrimination [32]. AUC≥0.75 indicates that for each pair of employees, the one at highest risk of LTSA will be correctly identified in 75% or more of the cases.

Results

Of the 4921 employees who completed the vitality check questionniare, 27 (5‰) had missing data on the MBI–GS, while there were no missing data on the UWES. A total of 4894 employees had complete data records for analysis; their characteristics are presented in Table 2. They had a mean standardized MBI–GS score of 19.4 (standard deviation [SD]=12.8) and a mean standardized UWES score of 63.0 (SD=16.3).

Table 2 Baseline study population characteristics (N=4894).

		Mean (SD)	N (%)
Age (years)		37.0 (10.6)	
Gender	men		2545 (52)
	women		2349 (48)
Marital status	single		1272 (26)
	cohabiting		3377 (69)
	living with parents		196 (4)
	other		49 (1)
Children at home	no		2692 (55)
	yes		2202 (45)
Employment	permanent		4502 (92)
	temporary		392 (8)
Work hours per week		39.5 (9.2)	
Work tenure (years)		13.9 (10.1)	
Job tenure (years)		4.8 (5.9)	
Monthly income (€)	<2000		527 (14)
	2000 – 2999		1420 (37)
	3000 – 3999		897 (24)
	4000 – 4999		481 (13)
	≥5000		492 (13)
	missing		1077
Body mass index		24.4 (3.6)	
Physical activities	never		147 (3)
	1x per week		587 (12)
	3x per week		1321 (27)
	5x per week		930 (19)
	daily		1909 (39)
Practising sports	never		979 (20)
	1x per week		1615 (33)
	3x per week		1762 (36)
	5x per week		294 (6)
	daily		244 (5)
Smoking	never		3817 (78)
	1x per week		245 (5)
	3x per week		147 (3)
	daily		685 (14)
Drinking alcohol	never		416 (10)
	1x per week		1083 (26)
	3x per week		1585 (37)
	daily		1164 (27)
	missing		646
Using soft drugs	never		2594 (98%)
	1x per week		53 (2%)
	missing		2247
Using hard drugs	never		3274 (100%)
	missing		1620
Using sedatives	never		4577 (96%)
	1x per week		95 (2%)
	3x per week		67 (1%)
	daily		29 (1%)
	missing		126

During 1-year follow-up, 103 employees (2%) had at least one LTSA episode: 43 (42%) employees had mental LTSA, 31 (30%) musculoskeletal LTSA, and 29 (28%) other somatic LTSA due to respiratory (N=9), neurologic (N=6), gastrointestinal (N=4), urogenital (N=4), cardiovascular (N=1), metabolic (N=1), and non-specified (N=4) disorders.

MBI–GS and LTSA

The total MBI–GS (P=0.004) and cynicism scale (P=0.005) score were positively associated with LTSA during 1-year follow-up, whereas exhaustion was not (P=0.059). Although prospectively associated with LTSA, the total MBI–GS showed poor discrimination with AUC=0.60 (95% CI 0.54–0.66). This means that for each pair of employees, MBI–GS will correctly identify the one at highest risk of LTSA in 60% of the cases. It should be reminded

that the probability of correctly allotting the highest risk by chance is 50%.

When stratifying by ICD-10 diagnosis, exhaustion (P=0.022), cynicism (P=0.024), and total MBI–GS (P=0.021) scores were positively associated with mental LTSA (Table 3). Discrimination between employees at high and low risk of mental LTSA was not practically useful with AUC=0.68 (95% CI 0.58–0.78) as is shown in Figure 1. MBI–GS scales and total MBI–GS score were not significantly associated with musculoskeletal and other somatic LTSA during follow-up.

Table 3 Burnout and long-term sickness absence (LTSA).
The table shows odds ratios (OR) with related 95% confidence intervals (CI) of logistic regression analysis of associations between baseline Maslach Burnout Inventory – General Survey (MBI–GS) scores and medically LTSA during 1-year follow-up, adjusted for LTSA in the year prior to baseline.

MBI–GS scale	Score range	mean (SD)	Sickness absence medically certified as: Mental (N=43)	Musculoskeletal (N=31)	Other somatic (N=29)	All medically certified sickness absences (N=103)
Exhaustion	0–30	6.3 (4.3)	1.12 (1.02–1.22)*	1.08 (0.89–1.32)	1.02 (0.94–1.10)	1.11 (1.00–1.25)
Cynicism	0–24	4.2 (3.5)	1.17 (1.02–1.34)*	1.12 (0.89–1.41)	1.08 (0.81–1.44)	1.17 (1.05–1.30)**
Total (standardized)	0–100	19.4 (12.8)	1.55 (1.07–2.25)†*	1.38 (0.74–2.58)†	1.13 (0.48–2.67)†	1.54 (1.14–2.06)†**

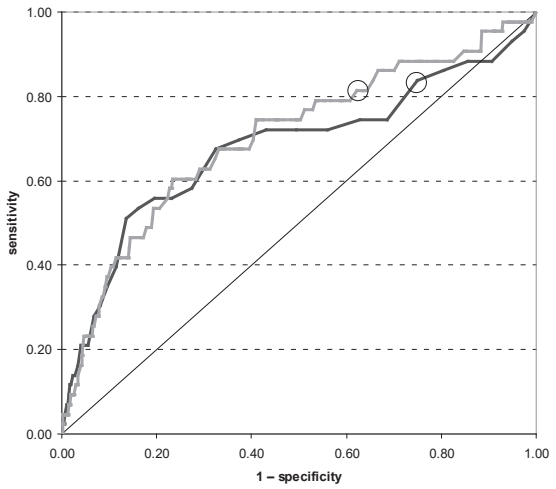
SD standard deviation

* P<0.05

** P<0.01

† per 10-point increase in standardized MBI–GS score

Figure 1 Discrimination graph for mental sickness absence.
The figure shows the receiver operating characteristic (ROC) curve. The area under the ROC-curve reflects discrimination between employees at high and low risk of mental absence by the Maslach Burnout Inventory – General Survey (MBI–GS, black line) and Utrecht Work Engagement Scale (UWES, grey line); the diagonal reflects no discrimination above chance and the circles indicate cut-offs at MBI–GS>10 and UWES<70 scores.



UWES and LTSA
Dedication was negatively associated (P=0.026) with the risk of LTSA, but the total UWES score was not associated (P=0.087) with all-cause LTSA during 1-year follow-up. Hence, it was not useful to investigate the ability of the UWES to discriminate employees at high risk of LTSA from those at low risk.

After stratifying LTSA by ICD-10 diagnosis, dedication (P=0.045), absorption (P=0.029), and total UWES (P=0.049) scores were associated with mental LTSA during follow-up (Table 4). The UWES moderately discriminated between employees with and without risk of mental LTSA (AUC=0.70; 95% CI 0.62–0.79). Discrimination between employees at high and low risk of mental LTSA did not improve when the UWES was used in combination with the MBI–GS: AUC=0.70 (95% CI 0.61–0.80).

Table 4 Work engagement and long-term sickness absence (LTSA).
The table shows odds ratios (OR) with related 95% confidence intervals (CI) of logistic regression analysis of associations between baseline Utrecht Work Engagement Scale (UWES) and medically LTSA during 1-year follow-up, adjusted for LTSA in the year before baseline and the type of employment (permanent vs. temporary).

UWES scale	Score range	mean (SD)	Sickness absence medically certified as: Mental (N=43)	Musculoskeletal (N=31)	Other somatic (N=29)	All medically certified sickness absences (N=103)
Vigor	0–36	22.7 (6.2)	0.94 (0.85–1.05)	1.01 (0.85–1.19)	0.94 (0.78–1.14)	0.96 (0.88–1.04)
Dedication	0–30	20.2 (5.6)	0.89 (0.80–1.00)*	0.96 (0.80–1.15)	0.90 (0.75–1.10)	0.91 (0.83–0.99)*
Absorption	0–36	21.4 (6.5)	0.89 (0.80–0.99)*	1.00 (0.85–1.17)	0.96 (0.80–1.15)	0.94 (0.87–1.02)
Total (standardized)	0–100	63.0 (16.3)	0.67 (0.45–0.99)*†	0.96 (0.51–1.80)†	0.76 (0.38–1.55)†	0.76 (0.55–1.03)†

SD standard deviation

* P<0.05

† per 10-point increase in standardized UWES score

Discussion

Total MBI–GS scores, but not UWES scores were prospectively associated with long-term (≥42 days) sickness absence (LTSA) irrespective of cause. After stratifying by LTSA cause, the MBI–GS was positively and the UWES negatively related to the risk of mental LTSA. Discrimination between employees at high and low risk of mental LTSA was not practically useful and did not improve when both instruments were used simultaneously. Our main impression from these results is that the MBI–GS and UWES fail to discriminate between employees at high and low risk of LTSA, but moderately discriminate between employees at high and low risk of mental LTSA. The MBI–GS and UWES might be used as tools to select employees for further assessment of their risk of mental LTSA.

Prospective associations of MBI–GS and UWES with LTSA

Our finding that MBI–GS was associated with higher odds of LTSA is in line with the results of previous studies [6,7,9-11,33]. We found that exhaustion was not significantly related to future LTSA, although the association was on the verge of significance. In this regard, it is interesting to note that Saastimoinen et al. [34] found no significant associations between exhaustion and sickness absence among Finnish employees in Helsinki, whereas Peterson et al. [11] did find significant associations in Swedish female health professionals. In contrast to Peterson et al. [11], our results showed a significant association between cynicism and LTSA. A relationship between cynicism and LTSA is plausible as higher cynicism levels represent more distance to work and may entail feelings of insufficiency, incapacity, and self-doubt. Cynical employees may ask themselves whether or not they will be able to return to work and, therefore, it may also take them longer to resume work.

The present study is the first to describe prospective relations between burnout and LTSA stratified by diagnosis. Burnout as measured with the MBI–GS was associated with mental LTSA, but not with musculoskeletal or other somatic LTSA. This makes sense because burnout is primarily a psychological condition, although hypofunction of the hypothalamic-hypophysial-adrenocortical axis has been described in burnout patients [35,36]. Cortisol levels 30 minutes upon awakening are low in burnout patients, particularly those reporting emotional exhaustion, but no associations were found between cynicism scores and cortisol levels [37].

This is also the first study that investigates the relationship between work engagement and LTSA in a heterogeneous sample of employees working in different economic sectors. Previously, work engagement was found to be associated with the frequency, but not duration of sickness absence in 201 managers and executives of a Dutch telecom company [7]. The present study confirmed that work engagement as measured with the UWES was not related to long duration sickness absence. However, UWES scores were negatively associated with the risk of future mental LTSA. This finding is in line with recent results of Leijten et al. [38] who reported that higher work engagement at baseline was related to better mental health during 1-year follow-up of 8837 Dutch workers aged 45-64 years.

Discriminative ability and practical implications

Peterson et al. [10] concluded that burnout measures might be useful to identify employees at risk of LTSA. The authors reported significant associations between exhaustion and LTSA, but significant associations are not sufficient to recommend using an instrument as tool to identify high-risk employees.

Although discrimination was not practically useful according to the guidelines of Fad et al. [32], our study showed that MBI–GS and UWES discriminated to some extent between employees at high and low risk of mental LTSA. The MBI–GS or UWES could be used as a primary screening tool, but there is no advantage in using both instruments simultaneously. To screen for risk of mental LTSA, we recommend cut-off scores MBI–GS>10 or UWES<70. However, ROC analysis shows that false positive rates at these cut-off points are high (75% and 62%, respectively). Previously, Kleijweg et al. [39] showed that the MBI–GS did not discriminate patients with burnout from those without burnout. The authors concluded that the MBI–GS should not be used by itself as a diagnostic tool, because of a high probability of overdiagnosing burnout. In line with these findings, we conclude that neither MBI–GS nor UWES should be used by itself as prognostic tool for mental LTSA because of a high probability of false positive findings (i.e., 'overprognosing' LTSA). Further examination of the psychological state of employees selected with MBI–GS or UWES is required to restrict unnecessary referral to interventions aimed at preventing mental LTSA.

Strengths and weaknesses of the study

The prospective design of the study and the use of different data sources (health check questionnaires and OHS register) are assets of the current study. The heterogeneous sample of employees working in different economic sectors is a further strength of the study, although the study population was not representative of the Dutch workforce, because employees in the public sector were predominantly working in healthcare and employees in the private sector in finance.

The use of OP-certified sickness absences is better than relying on employee-rated causes for sickness absence. Previously, O'Neill et al. [40] reported a good agreement between OPs and psychiatrists for the diagnosis 'mental illness'. An important weakness of the study, however, is that OPs could only certify LTSA with one ICD-10 diagnosis. Comorbidities could not be recorded in the OHS register. Physical illness has been reported to be more common in employees with burnout than in those without burnout [41,42] and many studies have demonstrated comorbidity between musculoskeletal disorders and mental health. Joint associations of emotional exhaustion and pain with sickness absence were found to be stronger than separate associations [34]. Thus, comorbid burnout and pain might be more predictive of LTSA than burnout alone.

Furthermore, the incidence of LTSA was low. Mental LTSA, for example, occurred in only 43 of 4894 (i.e., 8.8 per 1000) employees, which is half of the incidence previously reported for the Dutch workforce [43]. The low incidence may be due to the definition of LTSA as ≥42 consecutive days. Although shorter than in previous burnout studies [10-12], such long absence duration could have been too strict a criterion and may consequently have underestimated the prospective associations of MBI–GS and UWES with LTSA. However, when shorter absences would be defined as LTSA, we ran the risk that not all LTSA cases were medically certified. In that case, we would not have been able to stratify the analysis by LTSA cause.

An alternative explanation for the low LTSA incidence could be that healthy employees were over-represented among health check participants. The mean score for exhaustion was

6.3 (5 items) and for cynicism 4.2 (4 items); when divided by the number of items in each scale, mean scores were 1.3 and 1.1 respectively. In comparison, Leone et al. [44] found scores of 1.4 for exhaustion and 1.2 for cynicism in 8338 workers representative of the Dutch workforce. Thus, we concluded that 'healthy volunteer' bias was not likely in the present study population. Although there were few mental, musculoskeletal, and other somatic LTSA events, the number of events per variable was sufficient for stable predictions [45], because confounder analysis restricted the number of independent variables in the logistic regression models.

Conclusion

We conclude that baseline MBI–GS and UWES scores were prospectively associated with mental, but not musculoskeletal or other somatic LTSA during 1-year follow-up of Dutch employees working in different economic sectors. The ability of the MBI–GS and UWES to discriminate between employees at high and low risk of mental LTSA was moderate, but instruments could be used as primary screening tool to select employees for further assessment of mental LTSA risk.

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Chapter 3

Mental health symptoms identify workers at risk of long-term sickness absence due to mental disorders: prospective cohort study with 2-year follow-up.

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Abstract

Objective
Mental health problems are a leading cause of long-term sickness absence (LTSA). Workers at risk of mental LTSA should preferably be identified before they report sick. The objective of this study was to examine mental health symptoms as predictors of future mental LTSA in non-sicklisted workers.

Methods
Prospective cohort study of 4877 non-sicklisted employees working in distribution and transport. Mental health symptoms were measured at baseline in November 2010 with the Four-Dimensional Symptom Questionnaire (distress and depressed mood) and Maslach's Burnout Inventory (fatigue). Mental health symptom scores were analyzed against incident mental LTSA retrieved from an occupational health register in 2011 and 2012. The area under the receiver operating characteristic curve (AUC) represented the ability of mental health symptom scores to discriminate between workers with and without mental LTSA during 2-year follow-up.

Results
Complete cases analysis included 2782 (57%) employees working in distribution and transport of whom 73 had mental LTSA during 2-year follow-up. Distress fairly (AUC=0.75; 95% CI 0.67–0.82) and both depressed mood (AUC=0.64; 95% CI 0.57–0.72) and fatigue (AUC=0.61; 95% CI 0.53–0.69) poorly discriminated between workers with and without mental LTSA during 2-year follow-up. The discriminative ability of distress did not improve by adding depressed mood and fatigue.

Conclusions
Measurement of distress sufficed to identify non-sicklisted employees working in distribution and transport at risk of future mental LTSA. The Four-Dimensional Symptom Questionnaire distress scale is a promising tool to screen working populations for of mental LTSA, which enables secondary preventive strategies.

Introduction

Mental disorders are the leading cause of sickness absence and disability pensions in European countries [1]. The international Labour Organization put the costs of productivity loss, disability, and unemployment due to mental disorders at 3-4% of a country's gross domestic product [2]. Sickness absence due to mental illness is often long-lasting [3-7]. In The Netherlands the median duration of mental sickness absence has increased from 87 days in 2005 to 118 days in 2013 [8, 9]. The probability of resuming work decreases with increasing sickness absence duration [10,11]. In addition, prejudices and negative attitudes towards persons with mental illness may perpetuate sickness absence due to mental disorders [12,13]. Therefore, workers with an increased risk of mental illness should preferably be identified before they report sick. For this purpose, we need tools to screen non-sicklisted workers for risk of long-term sickness absence (LTSA) due to mental disorders.

Mental health symptoms are most obvious to identify workers at risk of mental LTSA. Several studies have reported prospective associations of psychological distress [14,15], depressed mood [16-18] and fatigue [14,19-21] with (mental) LTSA. However, prospective associations do not tell us whether these mental health symptoms identify non-sicklisted workers with an increased risk of mental LTSA. Few studies have investigated mental health symptoms as prognostic factors for all cause LTSA [22-24]. Thorsen et al. investigated the predictive value of the 5-item Mental Health Inventory (MHI-5) for LTSA in a random sample of 4153 Danish workers [22]. A one standard deviation increase in the MHI-5 score was associated with a 37% increase in LTSA risk. However, LTSA causes were not available so that the authors could not assess the predictive value of MHI-5 for mental LTSA. Roelen et al. investigated the Four-Dimensional Symptom Questionnaire (4DSQ) as prognostic instrument to predict future mental LTSA in 1137 non-sicklisted Dutch office workers [23]. They reported that the 4DSQ distress scale, but not the scales measuring depression, anxiety and somatization discriminated between workers who did and did not develop mental LTSA during 1-year follow-up [23]. In the same study population, fatigue was a prognostic risk factor of mental LTSA in men, but not in women [24].

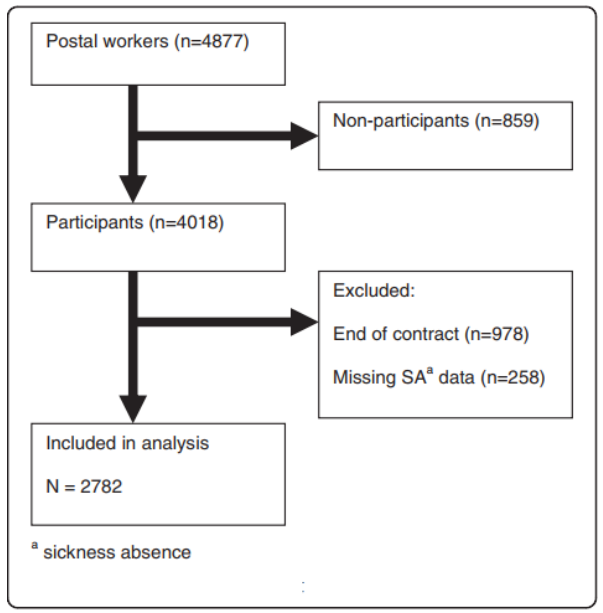
The objective of the present study was to examine instruments measuring mental health symptoms (distress, depressed mood, and fatigue) as tools to predict incident mental LTSA in non-sicklisted workers. If mental health symptom scores identify workers at risk of future mental LTSA, then we could develop strategies aimed at preventing mental LTSA.

Methods

Study population and design

Prospective cohort study with 2-year follow-up of 4877 non-sicklisted employees working in distribution and transport. At baseline (November 2010), the employees working in distribution and transport received a questionnaire about mental health, job demands, job resources, and work ability. A total of 4018 (82%) non-sicklisted employees working in distribution and transport completed the questionnaire. The questionnaire data were linked to incident mental LTSA occurring in the period January 2011 through December 2012 by citizen service number, a unique personal number assigned to every citizen registered in the Dutch Municipal Personal Records Database. Sickness absence data were not available for 1236 employees working in distribution and transport either because of missing or incorrect citizen service numbers (n=258) or because temporary contracts ended during 2-year follow-up (n=978). Consequently, 2782 (57%) employees working in distribution and transport were included in complete cases analyses (Figure 1). The Medical Ethics Committee of the University Medical Center Groningen granted ethical clearance for this study.

Figure 1 Study population flow chart.



Mental health symptoms

Distress was measured at baseline with the Four-Dimensional Symptom Questionnaire (4DSQ), which has been validated for use in the working population [25]. The 4DSQ distress scale consists of 16 items (score range 0–32; Cronbach's α=0.96) addressing symptoms elicited by stressors or the efforts to maintain psychosocial functioning, such as worry, irritability, tension, listlessness, poor concentration, sleeping problems and demoralisation [25,26]. Depressed mood was measured at baseline with four items (During the past month, did you feel that: everything is meaningless, life is not worth while, you can't enjoy anything anymore, there is no escape from your situation; α=0.90) derived from the 4DSQ depression scale [25,26]. Fatigue was measured at baseline with the 5-item exhaustion scale (α=0.95) of the Dutch Maslach Burnout Inventory–General Survey [27]. For comparability, all scale scores were standardized as percentage of the maximum score (range 0–100).

Outcome variable

Sickness absence was defined as temporary paid leave from work due to any (i.e., work-related as well as non-work-related) injury or illness and was recorded from the first to the last absence day in an occupational health register. In The Netherlands, sickness absence is employer-compensated when medically certified by an occupational physician (OP) within 42 days of reporting sick. Consequently, long-term sickness absence (LTSA) was defined as lasting ≥42 consecutive days. OPs certified sickness absence with a diagnostic code derived from the 10th International Classification of Diseases (ICD-10). LTSA certified with a diagnostic code within the ICD-10 chapter V (Mental and Behavioural Disorders) in 2011 was the outcome variable of the study. There was a gap between baseline (November 2010) and the start of follow-up (January 2011), but none of the employees working in distribution and transport initiated mental LTSA between November 2010 and January 2011.

Statistical analysis

Statistical analyses were done in IBM SPSS Statistics for Windows, version 20.0 (IBM Corp. Armonk, NY, released 2011). Baseline mental health symptom scores were associated with the occurrence of mental LTSA (no=0, yes=1) during 2-year follow-up by logistic regression analyses. The mental health symptoms were highly intercorrelated, particularly distress and depressed mood (Pearson correlation r=0.75), which corresponds with the previously reported overlap for the 4DSQ distress and depression scales [25]. To bypass collinearity, we calculated sum scores for combinations of mental health symptoms and performed logistic regression analyses with these sum scores as independent variables. Associations between mental health symptom scores and mental LTSA were checked by using spline regression curves, which revealed that all associations were linear. Furthermore, associations between mental health symptom scores and mental LTSA did not change with age and did not differ across gender and job [data not shown].

The ability of mental health symptom scores to discriminate between workers with ('cases') and without ('non-cases') incident mental LTSA during 2-year follow-up was investigated with receiver operating characteristic (ROC) analysis [29]. The area under the ROC-curve (AUC) is a measure for the discriminative ability of mental health symptom scores. If we randomly select one worker from the group of cases and one from the group of non-cases, then the AUC indicates the probability that the mental health symptom score correctly identifies a worker as case. AUC=0.50 reflects no discrimination above chance; AUC ≥0.90 represents perfect, 0.80–0.89 good, 0.70–0.79 fair, 0.60–0.69 poor, and <0.60 failing discrimination [30].

Results

The employees working in distribution and transport (n=1236) whose questionnaire results could not be linked to recorded sickness absence data were younger, more often male and had a shorter job tenure than employees working in distribution and transport (n=2782) whose questionnaire results could be linked to recorded sickness absence (Table 1). Baseline mental health symptom scores did not differ between employees working in distribution and transport with and without sickness absence data.

Table 1 Population characteristics (N=4018).

	Included in complete cases analyses (n=2782)		Excluded because of missing SA[a] data (n=1236)		Analysis
	Median (IQR[b])	n (%)	Median (IQR[b])	n (%)	
Age	49.9 (9.5)		34.1 (14.9)		*P*<0.01[c]
Gender					*P*<0.01[d]
men		1235 (44)		609 (49)	
women		1547 (56)		627 (51)	
Job tenure	5.2 (1.0)		1.7 (1.1)		*P*<0.01[e]
Work hours per week	22.4 (12.2)		10.6 (7.4)		*P*<0.01[e]
Job					*P*<0.01[d]
postmen		1046 (38)		1083 (88)	
post sorters		1455 (52)		64 (5)	
supervisor/manager		150 (5)		8 (1)	
other		131 (5)		81 (6)	
Mental health symptoms (range 0–100)					
distress	25.0 (9.0–53.1)		25.0 (6.3–53.1)		*P*=0.89[e]
depressed mood	0.0 (0.0–25.0)		0.0 (0.0–25.0)		*P*=0.12[e]
fatigue	32.0 (12.0–48.0)		28.0 (8.0–48.0)		*P*=0.29[e]

[a] Sickness absence.

[b] Interquartile range.

[c] t-test for independent samples.

[d] Chi-square test.

[e] Mann-Whitney U-test.

During 2-year follow-up, 679 employees working in distribution and transport had incident LTSA: 336 due to musculoskeletal disorders, 270 due to other somatic disorders (49% non-specified illness, 12% cardiovascular disease, 12% respiratory disease, 11% gastrointestinal disease, 16% other specified illness), and 73 due to mental disorders. Employees working in distribution and transport with mental LTSA had higher median scores on distress (40.5, interquartile range [IQR] 12.5 – 87.5), depressed mood (25.0, IQR 0.0 – 50.0), and fatigue (40.0, IQR 20.0 – 68.0) than employees working in distribution and transport without mental LTSA during follow-up, scoring 25.0 (IQR 9.4 – 53.1; Mann-Whitney P<0.01), 0.0 (IQR 0.0 – 25.0; Mann-Whitney P<0.01), and 28.0 (IQR 8.0 – 48.0, Mann-Whitney P<0.01) on distress, depressed mood, and fatigue, respectively.

Baseline mental health symptom scores were significantly associated with the occurrence of mental LTSA during 2-year follow-up (Table 2). Distress fairly discriminated between cases and non-cases and both depressed mood and fatigue poorly. The combination of distress with depressed mood and fatigue did not improve discrimination between cases and non-cases of mental LTSA during 2-year follow-up (Figure 2). Mental health symptoms failed to discriminate between employees working in distribution and transport with and without LTSA due to all causes (Table 2).

Table 2 Mental health symptom scores and long-term (≥42 days) sickness absence (LTSA).

Mental health symptom	Score (0–100)	Association with mental LTSA	Discrimination	
			Mental LTSA	All LTSA
	Median (IQR)[a]	OR (95% CI)[b]	AUC (95% CI)[c]	AUC (95% CI)[c]
Distress	25.0 (9.0–53.1)	1.17 (1.09 – 1.27)	0.75 (0.67 – 0.82)	0.56 (0.53 – 0.58)
Depressed mood	0.0 (0.0–25.0)	1.16 (1.07 – 1.26)	0.64 (0.57 – 0.72)	0.53 (0.51 – 0.56)
Fatigue	32.0 (12.0–48.0)	1.15 (1.04 – 1.27)	0.61 (0.53 – 0.69)	0.56 (0.54 – 0.59)
Distress + depressed mood	15.6 (4.7–39.1)	1.19 (1.10 – 1.28)	0.75 (0.67 – 0.82)	0.55 (0.53 – 0.58)
Distress + fatigue	27.4 (12.5–49.6)	1.20 (1.09 – 1.32)	0.74 (0.66 – 0.81)	0.57 (0.54 – 0.59)
Depressed mood + fatigue	20.0 (8.0–36.5)	1.21 (1.10 – 1.33)	0.65 (0.57 – 0.72)	0.56 (0.54 – 0.58)
Distress + depressed mood + fatigue	20.6 (8.1–41.0)	1.22 (1.11 – 1.31)	0.75 (0.67 – 0.83)	0.56 (0.54 – 0.58)

[a] Mean (interquartile range) standardized symptom score (range 0 to 100).

[b] Odds ratio (95% confidence interval) for a 10-point change in standardized mental health symptom score.

[c] Area under the receiver operating characteristic curve (95% confidence interval)

Figure 2 Discrimination graph. The figure shows the receiver operating characteristic (ROC) curve for different mental health symptoms scores as well as the combination of all mental health scores; the diagonal indicates no discrimination above chance.

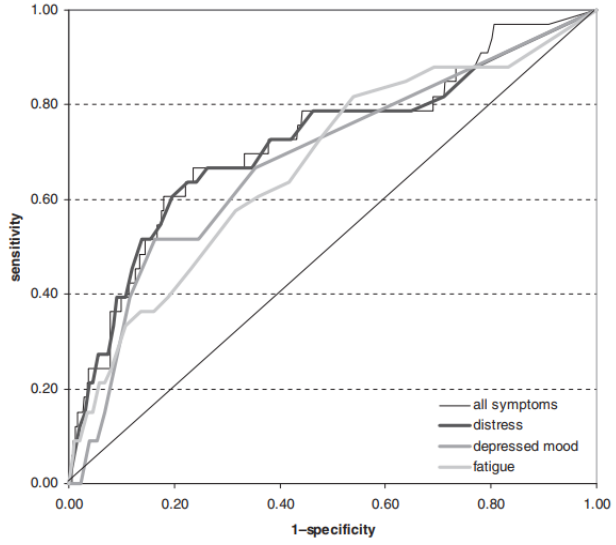


Table 3 shows the 4DSQ distress cut-off scores with sensitivities and specificities >0.40; positive predictive values were 0.02 and negative predictive values 0.99 for all cut-off scores shown in the table.

Table 3 Cut-off points for the distress scale (range 0–32).

Cut-off	N (%)	Sensitivity	Specificity
>6	1747 (63)	0.73	0.43
>7	1641 (59)	0.73	0.47
>8	1536 (55)	0.73	0.51
>9	1427 (51)	0.70	0.55
>10	1341 (48)	0.66	0.58
>11	1249 (45)	0.61	0.61
>12	1162 (42)	0.53	0.64
>13	1073 (39)	0.49	0.67
>14	1002 (36)	0.49	0.70
>15	918 (33)	0.48	0.72
>16	832 (30)	0.44	0.75
>17	765 (28)	0.44	0.77

Discussion

The risk of long-term (≥42 days) sickness absence (LTSA) due to mental disorders increased with distress, depressed mood, and fatigue scores. The 4DSQ distress scale discriminated between workers who did and did not develop mental LTSA during 2-year follow-up. Combining distress with depressed mood and fatigue scores did not improve discrimination.

The current findings confirm previously reported associations between mental health symptoms and mental LTSA. Previous research has shown that the 4DSQ distress scale discriminates between office workers with and without mental LTSA during 1-year follow-up [23], which corroborates the present findings in employees working in distribution and transport. Depressed mood measured with a 4-item scale derived from the 4DSQ poorly discriminated employees working in distribution and transport with mental LTSA from those without mental LTSA, which confirms earlier findings in Dutch office workers (23). Depressed mood may have been under-reported because of shame or anxiety of being prejudiced or stigmatized by superiors and colleagues [8,9]. This could also explain why depressed mood scores were lower than distress and fatigue scores among employees working in distribution and transport. Fatigue measured with Maslach's Burnout Inventory (MBI) poorly discriminated between employees working in distribution and transport with and without mental LTSA, which is also in line with previous results in a heterogeneous sample of Dutch workers [31].

Our study adds that combinations of distress with depressed mood and fatigue did not improve discrimination between workers who did and did not develop mental LTSA during 2-year follow-up. This may be due to the overlap between mental health symptoms. Terluin et al. reported that the 4DSQ distress scale shares 35-45% of its variance with the other 4DSQ scales, particularly the depression scale [25]. The probability of depressive and anxiety disorders has been found to increase with 4DSQ distress scores [32]. Distress might not only reflect the effort an individual has put into coping with psychosocial stressors, but might also result from coping with mood and other psychiatric disorders [33].

An alternative explanation why depressed mood did not improve discrimination might be the relatively low contribution of the depressed mood scale score. Depressed mood scores were much lower than distress scores and may have had little effect on the combined (i.e., distress and depressed mood) sum score. In addition, the majority of mental LTSA episodes in the Dutch workforce is OP-certified as being due to stress-related disorders (ICD-10 F43) [34]. Although mild depressive symptoms may occur, psychological distress is most characteristic for stress-related disorders. Besides distress, fatigue is a core symptom of many mental disorders, particularly burnout and depression. Distressed workers who experience fatigue have been reported to abandon social roles, such as the work role more often than distressed workers without fatigue [25]. Our present study, however, showed that the combination of distress and fatigue did not better discriminate between employees working in distribution and transport with and without mental LTSA during follow-up than distress alone. From these findings, we concluded that it would be appropriate to use the 4DSQ distress scale as tool to identify workers still at work, but at risk of mental LTSA.

Methodological considerations

The prospective design and large sample size are strengths of the study, although the study

population is not likely to be representative of the Dutch workforce. Although the response rate was high (75%), many young employees working in distribution and transport with short job tenure and working few hours/week were excluded from the analysis. They probably had temporary seasonal contracts. Consequently, post sorters with permanent contracts were over-represented in the study population. Furthermore, workers with complete data had higher mental health symptom scores than workers whose sickness absence data could not be linked to questionnaire results. This might have over-estimated associations between mental health symptoms and mental LTSA. However, it was reassuring that the discriminative ability of the 4DSQ distress scale was of the same magnitude as previously described for Dutch office workers. In prognostic research, the generalizability of results depends on the number of settings rather than the representativeness of the study population [35].

The low number of mental LTSA episodes would restrict the statistical power of the study when we would have added covariates to the analyses. Based on preliminary analyses we concluded that there was no need to include age, gender, or job in the analyses. As all analyses only included one independent variable, there was sufficient statistical power for estimating logistic regression coefficients, even with only 73 mental LTSA events.

Another limitation of the study was potential diagnostic misclassification. LTSA due to symptoms and signs not elsewhere classified (ICD-10 chapter XVIII), such as pain, weakness and tiredness were classified as LTSA due to somatic disorders, while some of these symptoms might be indicative of mental disorders. Furthermore, LTSA had to be certified within one ICD-10 chapter and comorbidities could not be recorded on the medical certificate. We dealt with potential misclassification and comorbidities by using LTSA due to all causes as outcome. Mental health symptoms failed to discriminate between postal workers with and without LTSA due to all causes.

The present results apply to the Dutch setting where sickness absence is certified within 42 days of reporting sick. It remains to be investigated whether or not workers at risk of mental LTSA can be identified in countries where shorter sickness absence episodes are medically certified. Shorter LTSA episodes are more common in the workforce. Consequently, the statistical power to detect workers at risk of mental LTSA will increase when shorter mental LTSA episodes are included. Alternatively, shorter mental LTSA episodes are less costly and the risk of exclusion from the workforce will be lower for workers experiencing a short episode of mental LTSA compared to workers suffering a long (≥42 days) episode of mental LTSA. This raises the question of the practical relevance in terms of the benefits and harm of screening for risk of short mental LTSA episodes. It is debatable whether it is beneficial to identify workers for interventions to prevent short mental LTSA episodes if this would lead to unnecessary stigmatization and increased utilization of health services.

Practical implications

The 16-item 4DSQ distress scale fairly discriminated between cases and non-cases of mental LTSA during 2-year follow-up. An AUC=0.75 indicates that if we randomly draw a worker from the group with mental LTSA and a workers from the group without mental LTSA, the distress scale will assign the highest risk of mental LTSA to the worker from the group with mental LTSA in 75% of the cases. If the current findings are confirmed in other working populations, then the 4DSQ distress scale could be used as tool to identify non-sicklisted workers with an increased risk of mental LTSA. Workers with high distress scores could then be referred for further mental health assessment and preventive treatment if appropriate.

The choice of a distress cut-off score depends on the objectives of case finding. Given the fact that mental LTSA has a median duration of 118 days [9] and the average productivity costs in The Netherlands are €30 ($35; £23) per hour [36], the median costs of mental LTSA episode may amount to more than €25,000 ($29,000; £19,000) for a full-time worker. These costs would plead for low distress cut-off scores so that as much cases as possible are identified and treated to prevent mental LTSA. We should be careful, however, not to medicalize transient psychological distress. Furthermore, mental LTSA is a rare event and, therefore screening for mental LTSA with low distress cut-off scores will identify more false-positives than true positives (i.e., mental LTSA cases). Thus, healthcare providers might choose distress cut-off scores with high specificity to only identify the highest risk workers and restrict false-positives. All the more because interventions aimed at reducing LTSA were found to be cost-effective among workers with a high LTSA risk, but not among workers with a moderately increased LTSA risk [37].

Apart from identifying individual workers for preventive interventions, the results of screening for risk of mental LTSA could be accumulated at the organizational level. Preventive interventions can then be targeted at departments or settings where many workers are at risk of mental LTSA. A review of intervention programs showed that combinations of person-directed and organization-directed interventions was most effective to prevent burnout, one of the main mental LTSA diagnoses [38].

Conclusions

The 4DSQ distress scale is a promising tool to identify non-sicklisted workers at risk of mental LTSA, which provides opportunities for developing strategies to prevent mental LTSA. The addition of other mental health symptoms, such as depressed mood and fatigue did not improve risk discrimination. The 4DSQ distress scale should be further investigated as tool to screen working populations for risk mental LTSA.

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Chapter 4

Psychological distress screener for risk of future mental sickness absence in non-sicklisted employees

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Abstract

Objective
Recently, a 3-item screener, derived from the 16-item distress scale of the Four-Dimensional Symptom Checklist (4DSQ), was used to measure psychological distress in sicklisted employees. The aim of the present study was investigate the ability of the 16-item distress scale and 3-item distress screener to identify non-sicklisted employees at risk of sickness absence (SA) due to mental disorders.

Methods
Prospective cohort study including 4877 employees working in distribution and transport. The 4DSQ distress scale was distributed at baseline in November 2010. SA diagnosed within the ICD-10 chapter F was defined as mental SA and retrieved from an occupational health register during 2-year follow-up. The area under the Receiver Operating Characteristic curve (AUC) was used to discriminate between workers with ('cases') and without ('non-cases') mental SA during follow-up.

Results
A total of 2782 (57%) employees were included in complete cases analysis; 73 employees had mental SA during 2-year follow-up. Discrimination between cases and non-cases was similar for the 16-item distress scale (AUC=0.721; 95%CI 0.622–0.823) and the 3-item screener (AUC=0.715; 95%CI 0.615–0.815).

Conclusion
Health care providers could use the 3-item distress screener to identify non-sicklisted employees at risk of future mental SA.

Introduction

One in five people of working age suffer a mental disorder. Mental disorders reduce an individual's ability to work and account for one third of all sickness absence (SA) and disability benefits [1]. In most European countries, health checks and surveys include items on employees' mental health. The 16-item distress scale of the Four-Dimensional Symptom Questionnaire (4DSQ) is commonly used in Dutch occupational health checks to measure mental health in working populations [2,3]. Roelen et al. (2014) showed that the 4DSQ distress scale correctly identified office employees at risk of mental SA in 76% of the cases [4]. Recently, the discriminative ability of the 4DSQ distress scale was confirmed in employees working in distribution and transport [5].

Apart from health checks, employees at risk of mental SA could be identified in consultations. The 16-items scale is too long an instrument for use in consultations with employees. It would be more convenient for health care providers to have a few key questions that identify employees still at work, but at risk of mental SA. Braam et al. [6] developed a 3-item screener from the 4DSQ distress scale and found that it was a valid tool to screen sicklisted employees for psychological distress. However, it is not clear whether this 3-item instrument can be used in non-sicklisted employees. Therefore we compared the abilities of the 3-item distress screener and the 16-item distress scale to identify employees at risk of mental SA.

Methods

Study population and design

A total of 4877 employees working in distribution and transport were invited for this prospective cohort study with 2-year follow-up[5]. The employees completed the 4DSQ in November 2010 and SA data were retrieved from an occupational health service (OHS) register in 2011 and 2012. The Medical Ethics Committee of the University Medical Center Groningen granted ethical clearance for this study.

Mental health symptoms

The 4DSQ is a 50-item self-administered questionnaire that measures psychological distress (16 items), somatization (16 items), anxiety (12 items) and depression (6 items) and has been validated for the working population [2,3]. For this study, we used the 4DSQ distress scale (16 items, Cronbach's α = 0.96) and identified the items on suffering from worry or listlessness and feeling tense for the distress screener (3 items, α = 0.89) according to Braam et al.6 Responses on items were given on a 5-point scale ranging from 'no' to 'always' and recoded into no=0, sometimes=1, and often/very often/always=2 to calculate scale scores ranging 0–32 for the 16-item distress scale and 0–6 for the 3-item distress screener. For comparability, 16- and 3-item distress scores were standardized as percentage of the maximum score after which all scores ranged between 0 and 100.

Outcome variable

SA was defined as temporary paid leave from work due to any (i.e., work-related as well as non-work-related) injury or illness and was recorded from the first to the last SA day in the OHS register with a diagnostic code of the 10th International Classification of Diseases (ICD-10). Mental SA was defined as long-term (i.e., ≥42 consecutive days) SA episodes diagnosed within the ICD-10 chapter F (Mental and Behavioral Disorders). Mental SA occurring (no=0, yes=1) in the period January 2011 to December 2012 was the outcome variable of this study.

Statistical analysis

Statistical analyses were done in IBM SPSS version 20.0 (IBM Corp. Armonk, NY, released 2011). Standardized 16-item distress scale and 3-item distress screener scores were included as continuous independent variables in separate logistic regression models with mental SA during 2-year follow-up as outcome variable. Odds ratios (OR) and corresponding 95% confidence intervals (CI) were estimated per 10-point increase in standardized score. Multiplicative interaction analyses showed that the interaction terms age*distress, gender*distress, and job type*distress were not significant with P=0.17, P=0.18, and P=0.29, respectively. Hence, there was no need to stratify the analyses by age, gender or job type. The accuracy of predictions by the 16-item distress scale and 3-item distress screener was measured with the Hosmer-Lemeshow (H-L) goodness-of-fit test. Non-significant (i.e., p≥0.05) H-L test results (i.e., predicted risks do not deviate significantly from observed risks) represent adequate accuracy of mental SA predictions [7,8]. Discrimination between employees with ('cases') and without ('non-cases') mental SA during 2-year follow-up was investigated with receiver operating characteristic (ROC) analysis. The area under the ROC-curve (AUC) is reflects the discriminative ability and AUC≥0.75 was regarded as practically useful discrimination [8].

Results

A total of 2782 employees (48% men) completed the 4DSQ. They were 47.4 (SD=12.4) years of age and worked 20.4 (12.3) hours per week for on average 12.3 (11.1) years. Non-responders (46% men) were younger (mean 45.2, SD=13.8 years; t-test P<0.01) than those who completed the 4DSQ.

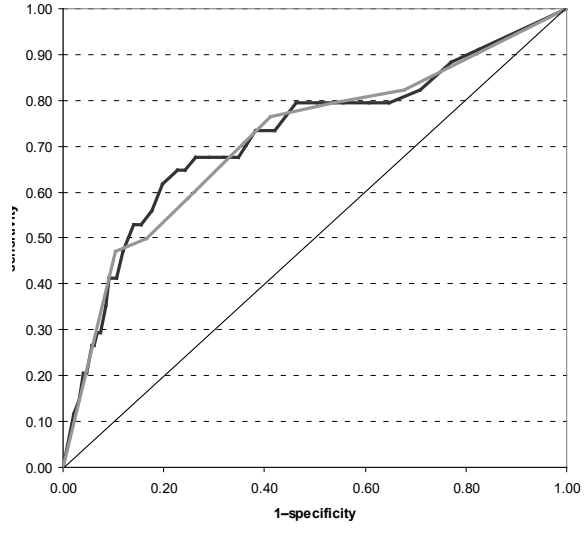
During 2-year follow-up, 73 employees had mental SA. The risk of mental SA increased with the scores of both the 16-item distress scale (OR=1.28; 95%CI 1.14–1.44) and the 3-item distress screener (OR=1.22; 95%CI 1.11–1.35). Mental SA predictions were adequate for both the 16-item distress scale (H-L model χ^2 6.63, df=7; P=0.47) and the 3-item screener (H-L model χ^2 7.49, df=5; P=0.19). Figure 1 shows that discrimination between cases and non-cases was similar for the 16-item distress scale (AUC=0.721; 95%CI 0.622–0.823) and the 3-item screener (AUC=0.715; 95%CI 0.615–0.815). The prognostic characteristics for different cutoff scores of the 3-item distress screener are presented in Table 1.

Table 1 Prognostic characteristics of the 3-item distress screener (score range 0–6).

Cut-off score	Sensitivity	Specificity	Predictive values	
			Positive	Negative
≥5	0.47	0.89	0.08	0.99
≥4	0.50	0.83	0.06	0.99
≥3	0.59	0.75	0.05	0.99
≥2	0.77	0.59	0.04	0.99
≥1	0.79	0.46	0.03	0.99
0	0.82	0.32	0.03	0.99

Figure 1 Discrimination graph.

The figure shows the receiver operating characteristic (ROC) curve for the 16-item distress scale (black line) and 3-item distress screener (grey line); the area under the ROC-curve represents the discriminative ability and the diagonal indicates no discrimination above chance.



Discussion

The 3-item distress screener identified non-sicklisted employees who are at increased risk of mental sickness absence (SA) as good as the 16-item distress scale. Previously, it was reported that the 3-item screener is a valid tool to identify sicklisted employees suffering from psychological distress [6]. The present study adds that the 3-item distress screener can also be used for identifying non-sicklisted employees at risk of future mental SA.

In many EU countries, mental SA is a leading cause of long-term SA [1]. Tackling SA due to mental disorders is a key issue for EU labor market and social policies. The WHO sets systematic gathering of mental health information as one of the four major objectives of the Comprehensive Mental Health Action Plan [9]. This would justify assessing the risk of future mental SA in non-sicklisted employees. Because mental SA is as common in employees doing production work as in those doing office work, we recommend using the 3-item distress screener in consultations with employees in all types of workplaces [10].

When health providers assess the risk of future mental SA in all employees, there is a substantial chance that employees are falsely identified as having an increased risk of mental SA. The false positive rates depend on the cutoff score. Previously, Braam et al. advised a cutoff score ≥4 to diagnose distress in sicklisted employees [6]. In our study, specificity at this cutoff was 0.83, indicating that 17% of the non-cases would be falsely identified as case. Alternatively, sensitivity was 0.50, indicating that 50% of the cases would be missed when using this cutoff score. We recommend cutoff scores ≥5 for identifying the employees at highest risk of mental SA. Health care providers who want to identify as many employees at risk of mental SA as possible should choose cutoff scores ≥2.

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Chapter 5

Psychosocial work environment and mental-health related long-term sickness absence among nurses

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Abstract

Objective
We investigated which job demands and job resources were predictive of mental health-related long-term sickness absence (LTSA) in nurses.

Methods
The data of 2059 nurses were obtained from the Norwegian Survey of Shift work, Sleep and Health. Job demands (psychological demands, role conflict, and harassment at the workplace) and job resources (social support at work, role clarity, and fair leadership) were measured at baseline and linked to mental health-related LTSA during 2-year follow-up. Cox regression models estimated hazard ratios (HR) and related 95% confidence intervals (CI). The c-statistic was used to investigate the discriminative ability of the Cox regression models.

Results
A total of 1533 (75%) nurses were included in the analyses; 103 (7%) of them had mental health-related LTSA during 2-year follow-up. Harassment (HR=1.07; 95% CI 1.01–1.17) and social support (HR=0.92; 95% CI 0.87–0.98) were associated with mental health-related LTSA. However, the Cox regression model did not discriminate between nurses with and without mental health-related LTSA (c=0.59; 95% CI 0.53–0.65).

Conclusions
Harassment was positively and social support at the workplace was negatively related to mental health-related LTSA, but both failed to discriminate between nurses with and without mental health-related LTSA during 2-year follow-up.

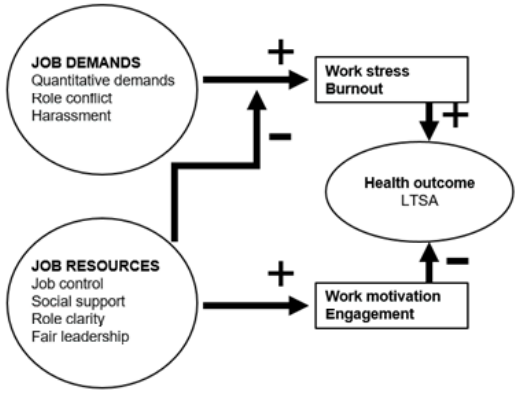
Introduction

Mental health problems are the most important contributors to illness in the workforce. In 2000, the World Health Organization estimated that 15-30% of employees will experience mental health problems during their working life [1]. Recently, the Organization for Economic Co-operation and Development reported that 30% to 40% of all sickness absence and work disability cases within its member countries were related to mental health problems [2]. Sickness absence due to physician-diagnosed mental health symptoms (e.g., feeling anxious, nervous, stressed, depressed) or physician-diagnosed psychiatric disorders is referred to as mental health-related sickness absence. The costs of mental health-related sickness absence amount to 3-4% of the gross national product of OECD countries. This is partly due to the long duration of mental health-related sickness absence. A median mental health-related sickness absence duration of 3 months was reported from a Dutch occupational health service register including the sickness absence data of more than one million workers [3]. Nielsen et al. reported a median duration of 6 months for mental health-related sickness absence in a sample of Danish workers [4]. Mental health-related long-term sickness absence (LTSA) disconnects employees from the workplace, which increases the risk of withdrawal from the labour market into states of disability or unemployment [5].

Work is generally beneficial for mental health [6]. However, various physical and psychosocial aspects of work are associated with mental ill-health. Stansfeld and Candy [7] reviewed the literature on psychosocial work environment and mental health. Most studies included in their review used the Demand – Control – Support (DCS) model as a theoretical framework to describe the psychosocial work environment. The DCS-model posits that work stress occurs in situations where psychological demands are high and job control is low. Social support received from supervisors and colleagues is assumed to buffer the effects of high psychological demands and low control [8]. An alternative theoretical framework that is commonly used to describe the psychosocial work environment is the Effort – Rewards Imbalance (ERI) model. The ERI-model states that the combination of putting high effort in work and receiving little rewards (e.g., salary, promotion, and esteem) increases the risk of work stress and negative health outcomes, particularly in employees who are overly committed to their work [9]. From their systematic review of the literature, Stansfeld and Candy [7] concluded that high psychological demands, low decision latitude, and combinations of high efforts and low rewards were prospective risk factors for mental health problems.

The Job Demands – Resources (JDR) model includes a wider set of work characteristics to describe the psychosocial work environment than both the DCS- and ERI-models [10]. The JDR-model posits that any job demand (i.e, aspect of the job that requires physical and/or psychological effort) and any job resource (i.e., aspect of the job that is functional for achieving goals and/or stimulates personal development) can affect an employee's mental health [10,11]. The impact of job demands and job resources on mental health differs across workplace settings [12]. The JDR-model describes a mental health impairment process, in which sustained high demands lead to work stress and burnout when employees cannot sufficiently recover from the efforts to meet high job demands. Job resources mitigate the effect of high job demands, but also drive a motivational process by facilitating the achievement of work goals and by fostering personal growth and development (Figure 1).

Figure 1 The Job Demands – Resources model.



JDR-model and mental health among nurses

A recent study showed that employees in the healthcare sector report higher cognitive demands than employees in industry or public service [13]. Besides cognitive demands, nurses experience the emotional demands of caring for patients and dealing with illness [14-15]. Therefore, nurses may be at increased risk of mental health problems and mental health-related LTSA.

Using the JDR-model as a theoretical framework, Hansen et al. [18] reported that job demands in terms of workload and role conflict were associated with emotional exhaustion among Swedish nurses in acute care hospitals. In contrast, job resources (i.e., autonomy, goal clarity, work group support, supervisor support, and job challenge) were unrelated to emotional exhaustion. Jourdain and Chênevert [19] reported that quantitative overload, role stress, work – family interference, and hostility from physicians and patients were associated with emotional exhaustion among Canadian nurses working in the public health care sector. Low psychological empowerment, poor support from supervisor and colleagues, and lack of recognition by physicians were associated with cynicism. Spence-Laschinger et al. [20] showed that job demands (i.e., workload and bullying), but not job resources (i.e., control over work and supportive work environment) were associated with poor mental health in newly graduated Canadian nurses. Vander Elst et al. [21] found that workload and emotional demands, but not aggression at the workplace were positively associated with burnout among Belgian home care nurses. The job resources autonomy, social support, and learning opportunities were associated with higher levels of work engagement and lower levels of burnout.

In conclusion, most studies have reported that job demands are associated with emotional exhaustion and burnout, while the effect of job resources on nurses' mental health is not yet clear. Not all nurses with mental health problems report sick. In the literature, we found no studies on the relationship of job demands and job resources with mental health-related LTSA, while sickness absence is an important issue in healthcare where nursing staff shortages are still a problem [22-24]. Therefore, we investigated which job demands and job resources are associated with mental health-related LTSA among nurses.

Methods

Study setting and sample

Data were retrieved from the Norwegian Survey of Shift work, Sleep and Health (SUSSH), which has been described previously [25,26]. A random sample of 5400 nurses working at least 50% of a full position received a baseline survey in November 2008. For the present study, we used the data of all 2059 (38%) nurses who completed the baseline SUSSH survey. The job demands and job resources measured by the SUSSH survey were linked to sickness absence records in 2009 and 2010 obtained from Statistics Norway. A total of 526 nurses did not give informed consent to link the survey data to their sickness absence registry data and were therefore excluded from the analyses. Their baseline characteristics did not differ from the 1533 nurses included in the analyses (Table 1).

Table 1 Baseline characteristics of the study population (N=2059).
The table compares the baseline characteristics of nurses who did and did not consent to linking questionnaire data to sickness absence registry data.

		Consent (n=1533) mean (*SD*[a])	*n* (%)	No consent (n=526) mean (*SD*[a])	*n* (%)	Significance level
Age (in years)		33.1 (8.3)		33.1 (7.8)		*P*=0.98[b]
Sex	women		1381 (90)		476 (90)	*P*=0.73[c]
	men		145 (10)		47 (10)	
	missing		7		3	
Marital status	single		397 (26)		139 (27)	*P*=0.78[c]
	married/cohabiting		1126 (74)		379 (73)	
	missing		10		8	
Care for children at home	no		725 (49)		228 (49)	*P*=0.06[c]
	yes		745 (51)		269 (51)	
	missing		63		29	
Setting	somatic care		1143 (75)		409 (79)	*P=0.13*[c]
	psychiatric care		220 (15)		61 (12)	
	nursing homes		57 (4)		16 (3)	
	home care		55 (4)		20 (4)	
	other healthcare settings		45 (3)		15 (3)	
	missing		13		5	
Years registered as nurse		5.1 (4.2)		5.3 (4.7)		*p*=0.76[d]
Work hours/week		34.0 (6.5)		33.6 (6.7)		*p*=0.45[d]

Psychosocial work characteristics					
Psychological demands (5–20)	14.3 (2.7)		14.4 (2.7)		p=0.29[b]
Decision latitude (6–24)	17.7 (2.1)		17.6 (2.1)		p=0.49[b]
Social support at work (6–24)	17.4 (3.6)		17.5 (3.6)		p=0.94[b]
Role clarity (0–10)	4.2 (0.7)		4.2 (0.8)		p=0.82[b]
Role conflict (0–10)	2.7 (0.8)		2.7 (0.7)		p=0.91[b]
Fair leadership (0–10)	4.1 (0.8)		4.1 (0.8		p=0.79[b]
Harassment (9–45)	10.7 (2.4)		10.6 (2.4)		p=0.39[b]

[a] standard deviation

[b] parametric student t-test

[c] chi-square test

[d] non-parametric Mann-Whitney test

Job demands and resources

The SUSSH survey measured psychological job demands, decision latitude, and social support with subscales of the Job Content Questionnaire [27]. Psychological demands were measured with 5 items (Crohnbach's α=0.78), decision latitude with 6 items (α=0.52), and social support at work with 6 items (α=0.82). Responses on all subscales were scored on a 4-point frequency scale (often – sometimes – seldom – never) and summed so that higher scores represented higher psychological demands, higher decision latitude, and higher social support at work. Based on its low Cronbach's alpha, we excluded decision latitude from the analyses.

The baseline SUSSH survey measured role clarity (3 items, α=0.77), role conflict (3 items, α=0.73), and fair leadership (3 items, α=0.73) with subscales of the General Nordic Questionnaire for Psychological and Social Factors at Work [28]. Responses on all subscales were scored on a 5-point frequency scale (very often – rather often – sometimes – rather seldom – very seldom) and summed so that higher scores represented higher levels of role clarity, role conflict and fair leadership.

The baseline SUSSH survey measured harassment at the workplace with the 9-item Negative Acts Questionnaire (NAQ-9, α=0.75). NAQ-9 contains items on persistent criticism, gossip, offensive remarks, and threats or actual abuse by colleagues, supervisors, or patients [29]. NAQ-9 items were scored on a 5-point frequency scale (never – now and then – monthly – weekly – daily) and a sum score was calculated if at least six NAQ-9 items had been answered, otherwise the NAQ score was set as missing; higher NAQ-9 sum scores reflected more frequent harassment.

The JDR-model was used as a theoretical framework for the present study. Psychological demands, role conflict, and harassment at the workplace were considered job demands. Alternatively, social support at work, role clarity, and fair leadership were considered job resources (Figure 1).

Sickness absence

In Norway, the first year of sickness absence is fully (i.e., 100% of the income) compensated; the employer pays the first 16 days of sickness absence and thereafter the state financially compensates sickness absence. Statistics Norway records sickness absence from the 17th sickness absence day onward, supplied with diagnostic codes of the International Classification of Primary Care (ICPC) given by the general practitioner or treating clinician. The ICPC is formally recognised by the World Health Organization (WHO) as a classification system for diseases encountered in primary care and general practice (World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians, 2016) [30]. It contains categories for general and unspecified symptoms as well as disorders related to body systems, mapped in line with the International Classification of Diseases (ICD).

For this study, we obtained sickness absence data recorded by Statistics Norway in 2009 and 2010. Because Statistics Norway records sickness absence from the 17th day onward, we defined sickness absence lasting ≥17 consecutive days as long-term sickness absence (LTSA). All-cause LTSA was defined as LTSA irrespective of ICPC diagnosis and mental health-related LTSA was defined as LTSA diagnosed within the ICPC category P (which corresponds to the ICD-10 chapter V of Mental and behavioural disorders).

Data analysis

All statistical analyses were done at the University of Bergen (Norway) in R for Windows version 3.24, using the survival package version 2.41-2 [31]. Prospective associations were investigated by including the job demands and job resources separately as continuous independent variables in Cox regression models. Cox regression models estimate hazard ratios (HR) and related 95% confidence intervals (CI). The HR can be interpreted as a relative risk on average over time; a HR>1 indicates an increased risk and shorter time to onset of mental health-related LTSA, whereas HR<1 represents a reduced risk and longer time to onset of mental health-related LTSA. HRs were adjusted for the sociodemographic variables age (in years), sex (male, female), marital status (single, married/cohabiting), and care for children at home (yes, no) retrieved from the baseline SUSSH survey. Furthermore, HRs were adjusted for the work-related variables workplace setting (somatic care, psychiatric care, nursing homes, home care, and other healthcare settings), years registered as a nurse, and work hours/week addressed by the survey.

After having assessed the prospective associations with mental health-related LTSA, all job demands and job resources were included in a multivariable prediction model with the time to mental health-related LTSA as outcome variable. The Wald-statistic was used to assess the strength of the predictor variables: higher Wald-statistics represented stronger predictors of mental health-related LTSA. The prediction model was reduced by backward stepwise procedures using the likelihood ratio (LR) test to compare models. Akaike's Information Criterion (AIC, corresponding with p<0.157) was used as stopping rule for the backward stepwise model reduction. The concordance (c) statistic reflects the ability of the final prediction model to discriminate between nurses with and without mental health-related LTSA during 2-year follow-up [32]. We interpreted c<0.60 as failing, 0.60-0.69 poor, 0.70-0.79 fair, 0.80-0.89 good, and 0.90-1.00 as perfect discrimination.

For comparison, the same analyses were done for all-cause LTSA, censoring LTSA episodes due to pregnancy, childbirth and family planning (ICPC chapter W).

Results

Data from 1533 nurses working in somatic care (75%), psychiatric care (15%), nursing homes (4%), home care (4%), and other healthcare settings (2%) were eligible for the analyses. Their baseline characteristics are shown in Table 1.

Mental health-related LTSA

During the 2-year follow-up period, 103 (7%) nurses had mental health-related LTSA median 305 (interquartile range [IQR] 163 – 401) days after baseline. Harassment was associated with a higher risk of mental health-related LTSA, whereas the other job demands were unrelated to mental health-related LTSA (Table 2). Of the job resources, social support at work was associated with a lower risk of mental health-related LTSA.

Table 2 Associations between psychosocial work characteristics and mental health-related LTSA among nurses.
The table shows hazard ratios and related 95% confidence intervals; HR > 1 indicates a shorter and HR < 1 a longer time to onset of mental health-related LTSA; * significant at 5% and ** significant at 1% level.

	Unadjusted model	Model 1[a]	Model 2[b]	Model3[c]
Job demands				
Psychological demands	1.04 (0.97 – 1.12)	1.05 (0.97 – 1.13)	1.02 (0.93 – 1.12)	1.03 (0.93 – 1.14)
Role conflict	1.17 (0.92 – 1.50)	1.24 (0.95 – 1.62)	1.12 (0.71 – 1.46)	1.25 (0.72 – 1.52)
Harassment	1.06 (1.00 – 1.14)*	1.08 (1.01 – 1.16)*	1.02 (0.93 – 1.12)	1.06 (1.01 – 1.19)*
Job resources				
Social support at work	0.92 (0.88 – 0.97)**	0.92 (0.87 – 0.97)**	0.93 (0.87 – 0.97)**	0.93 (0.86 – 0.98)**
Role clarity	0.80 (0.61 – 1.05)	0.80 (0.60 – 1.06)	0.92 (0.66 – 1.21)	0.82 (0.65 – 1.11)
Fair leadership	0.84 (0.66 – 1.07)	0.89 (0.69 – 1.15)	0.87 (0.70 – 1.23)	0.90 (0.64 – 1.28)

[a] Model 1 adjusted for sociodemographic variables: age, sex, marital status, and care for children at home

[b] Model 2 adjusted for work-related variables: workplace setting, years registered as nurse, and work hours/week

[c] Model 3 fully adjusted for sociodemographic and work-related variables

All-cause LTSA

A total of 325 (21%) nurses had all-cause LTSA median 294 (IQR 122 – 418) days after baseline. Harassment was positively associated with all-cause LTSA. The resources social support at work and fair leadership were negatively associated with all-cause LTSA. Associations between fair leadership and all-cause LTSA became non-significant after adjustment for work-related variables (Table 3).

Table 3 Associations between psychosocial work characteristics and all-cause LTSA among nurses.
The table shows hazard ratios and related 95% confidence intervals; HR > 1 indicates a shorter and HR < 1 a longer time

	Unadjusted model	Model 1[a]	Model 2[b]	Model 3[c]
Job demands				
Psychological demands	1.04 (0.99 – 1.08)	1.04 (0.99 – 1.09)	1.02 (0.97 – 1.07)	1.02 (0.96 – 1.07)
Role conflict	1.00 (0.85 – 1.17)	1.04 (0.88 – 1.22)	1.03 (0.89 – 1.21)	1.07 (0.91 – 1.29)
Harassment	1.06 (1.01 – 1.10)*	1.06 (1.01 – 1.11)*	1.05 (1.01 – 1.10)*	1.06 (1.02 – 1.11)*
Job resources				
Social support at work	0.96 (0.92 – 0.99)*	0.96 (0.92 – 0.99)*	0.97 (0.93 – 1.00)*	0.95 (0.91 – 0.99)**
Role clarity	0.96 (0.81 – 1.15)	0.95 (0.80 – 1.14)	0.99 (0.83 – 1.20)	0.99 (0.82 – 1.20)
Fair leadership	0.83 (0.71 – 0.96)*	0.84 (0.72 – 0.98)*	0.87 (0.75 – 1.02)	0.90 (0.75 – 1.07)

to onset of mental health-related LTSA; * significant at 5% and ** significant at 1% level.

[a] Model 1 adjusted for sociodemographic variables: age, sex, marital status, and care for children at home

[b] Model 2 adjusted for work-related variables: workplace setting, years registered as nurse, and work hours/week

[c] Model 3 fully adjusted for sociodemographic and work-related variables

Prediction models for mental health-related and all-cause LTSA

When all job demands and job resources were included in a multivariable prediction model, social support was the strongest predictor of both mental health-related and all-cause LTSA. Fair leadership was the weakest predictor, but adhering to the AIC both the model predicting mental health-related LTSA (LR-test p=0.152) and the model predicting all-cause LTSA (LR-test p=0.004) deteriorated significantly if fair leadership was removed from the model. As a consequence, all job demands and job resources stayed in the final models. The c-statistics 0.59 (95% CI 0.53 – 0.65) and 0.56 (95% CI 0.53 – 0.60) indicated failing discrimination by the models predicting mental health-related and all-cause LTSA, respectively.

Table 4 Multivariable prediction model including all job demands and job resources.
The table shows Cox regression coefficients (B), related standard errors (SE), and the Wald-statistic (higher Wald-statistics reflect stronger predictors of (mental health-related) long-term sickness absence (LTSA)).

	Mental health-related LTSA		All-cause LTSA	
	B (SE)	Wald	B (SE)	Wald
Psychological demands	0.012 (0.046)	0.074	0.021 (0.028)	0.571
Role conflict	0.009 (0.174)	0.003	0.010 (0.019)	0.272
Harassment	0.017 (0.014)	1.474	0.197 (0.085)	5.380
Social support at work	-0.077 (0.037)	4.312	-0.227 (0.092	6.138
Role clarity	-0.086 (0.162)	0.282	-0.034 (0.024)	2.029
Fair leadership	-0.005 (0.155)	0.001	-0.001 (0.092)	0.000

Discussion

The present study showed that harassment at the workplace was associated with an increased risk of mental health-related LTSA among nurses. Social support at work was associated with a reduced risk of mental health-related LTSA. However, a prediction model including harassment and social support failed to discriminate between nurses with and without mental health-related LTSA during 2-year follow-up.

Job demands, job resources and mental health-related LTSA

We found that harassment at the workplace was an important risk factor for mental health-related LTSA among nurses. A recent review of the literature showed that one-third of the nurses worldwide are exposed to physical violence, and two-thirds are exposed to non-physical violence [33]. Harassment and other negative acts at the workplace have been associated with poor health outcomes among nurses [34-36]. Previously, Reknes et al. found reciprocal relationships between bullying and mental health [25]. The authors showed that bullying behaviours at baseline predicted increased symptoms of anxiety and fatigue one year later. Conversely, symptoms of anxiety, depression and fatigue at baseline predicted increased exposure to bullying one year later. Our present study adds that harassment at the workplace increases the risk of future mental health-related LTSA in nurses.

The literature on associations of job demands and job resources with mental health-related LTSA is scarce. In a cross-sectional study of a sample of Swedish council employees, psychological demands and role conflict were positively correlated, whereas role clarity, support from the supervisor and co-workers, and fair leadership were negatively correlated with mental health-related LTSA [28]. In the present study, we found that social support was negatively associated with mental health-related LTSA among nurses. Fair leadership was associated with all-cause, but not mental health-related LTSA. We failed to find significant associations of psychological demands and role conflict with (mental health-related) LTSA among nurses. These different findings may be due to differences in study population and design. Cross-sectional correlations between self-reported psychosocial work characteristics and mental health-related LTSA may have been inflated if subjects with poor mental health perceive work characteristics more negatively than healthy subjects [37].

An alternative explanation for the different findings might be diagnostic misclassification. For example, if nurses with mild mental disorders present with non-specific symptoms such as tiredness and listlessness, they were classified within the ICPC category A of general and unspecified symptoms. In the same vein, nurses presenting with headache, muscle pain, or other psychosomatic symptoms may have been misclassified within the ICPC N (neurological), L (musculoskeletal), or other somatic categories, respectively. For this reason and to compare our present results with those of previous studies, we investigated associations between psychosocial working conditions and all-cause LTSA.

Job demands, job resources and all-cause LTSA

Some studies have used the JDR-model as a theoretical framework to investigate the effect of job demands and job resources on LTSA irrespective of diagnosis [38-40]. However, few studies were conducted in the healthcare sector. Clausen et al. [41] reported that emotional, but not cognitive demands were associated with an increased risk of LTSA in Danish eldercare workers. This corroborates our finding that psychological demands were not associated with LTSA. Unfortunately, the SUSSH survey did not measure emotional demands. In contrast to our findings, Clausen et al. [41] found that role conflict was positively associated with LTSA in Danish eldercare workers . Possibly, role conflicts were more of a problem in the Danish eldercare workers, given the fact that the levels of role conflict measured by Clausen and colleagues were twice the levels measured in the present study. Our finding that fair leadership and social support at work were associated with a reduced risk of all-cause LTSA was in agreement with the results of Clausen et al. [41], who showed that the quality of leadership and a good team climate were associated with a reduced risk of LTSA among Danish eldercare workers.

In a later study, Clausen et al. [42] reported that high job demands (workpace and psychological demands) and low job resources (influence at work and quality of leadership) were associated with a higher LTSA risk among 39,408 Danish workers employed in various occupations. These findings not only differ from our present results, but also from Clausen's previous findings in the healthcare sector [41]. Probably, the associations of job demands and job resources with LTSA vary across working populations and workplace settings [12].

Strengths and limitations

The prospective design and the use of recorded sickness absence data were significant assets of the present study. Still, there are some methodological limitations that should be mentioned. First, the baseline SUSSH response rate was 38%, which could have introduced selection bias at the start of SUSSH. It has been reported that healthy subjects are more inclined to participate in health surveys than subjects with health problems [43]. Such healthy-volunteer bias may have led to an under-estimation of associations between psychosocial work characteristics and (mental health-related) LTSA.

Furthermore, nurses with stress-related disorders who presented with non-specific symptoms (e.g., tiredness and listlessness) or somatic symptoms (e.g., headache, muscle pain) may have been classified in ICPC categories other than the P-category and were therefore not regarded as having mental health-related LTSA. Consequently, the present results might particularly apply to nurses with specific mental disorders, such as depressive and anxiety disorders rather than non-specific stress-related disorders. In that regard, it is interesting to note that systematic reviews of the literature have provided evidence for an association between low social support at work and depression [44,45].

Practical implications and directions for further research

The current findings are important for nurse managers, as the results show that nurse managers can play a prominent role in reducing LTSA, for example by encouraging social support and creating a good social climate in nursing teams. We measured fair leadership by asking nurses if their managers treated them fairly and distributed work equally and impartially across the team. Thus, nurse managers could reduce LTSA by fairly treating their personnel and fairly distributing work over their nursing teams. In a systematic review of the literature, Cummings et al. [45] found evidence for better health outcomes in nurses of teams led by supportive managers as compared to task-oriented or laissez-faire managers. Schreuder et al. [47] showed that teams led by relationship-oriented nurse managers had fewer

sickness absence days than teams lead by task-oriented nurse managers.

The relationship between job demands, job resources, and (mental health-related) LTSA differs across working populations and workplace settings. The nurses included in SUSSH came from various workplace settings from all over Norway. We presume that harassment and social support at the workplace are general risk factors of mental health-related LTSA among nurses. However, we could not rule out that other psychosocial work characteristics play an important role at the organizational level. For example, psychological demands and workpace may be risk factors in wards where workload and time pressure are high. Hence, nurse managers should consider measuring job demands and job resources in their ward to find grounds for managing mental health-related LTSA.

Although associated with future mental health-related LTSA, harassment and social support at the workplace failed to discriminate between nurses with and without mental health-related LTSA during the 2-year follow-up period. Probably, the discriminative ability of job demands and resources is limited because psychosocial work characteristics vary across workplace settings. Furthermore, there are indications that the associations between job demands, job resources, and LTSA are moderated by other factors, such as work-home interference [48] and work engagement [49]. Future studies could investigate if these moderating factors add to the discrimination between nurses with and without mental health-related LTSA. Besides measuring the experienced levels of job demands and job resources, it would be interesting to investigate how workers value job demands and job resources [50]. Demands and resources valued important for a given workplace setting may better discriminate between workers with and without LTSA than job demands and job resources which are not valued important.

Conclusions

Harassment at the workplace was associated with an increased risk of mental health-related LTSA, whereas social support at the workplace was associated with a reduced risk of mental health-related LTSA. The other job demands and job resources failed to identify nurses at increased risk of mental health-related LTSA.

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Chapter 6

Psychosocial work characteristics and long-term sickness absence due to mental disorders

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Abstract

Objective
Psychosocial work characteristics are associated with all-cause long-term sickness absence (LTSA). This study investigated whether psychosocial work characteristics such as higher workload, faster pace of work, less variety in work, lack of performance feedback, and lack of supervisor support are prospectively associated with higher LTSA due to mental disorders.

Methods
Cohort study including 4,877 workers employed in the distribution and transport sector in The Netherlands. Psychosocial work characteristics were included in a logistic regression model estimating the odds ratios (OR) and 95% confidence intervals (CI) of mental LTSA during 2-year follow-up. The ability of the regression model to discriminate between workers with and without mental LTSA was investigated with the area under the receiver operating characteristic curve (AUC).

Results
2,782 (57%) workers were included in analysis; 73 (3%) had mental LTSA. Feedback about one's performance (OR=0.82; 95% CI 0.70–0.96) was associated with mental LTSA. A prediction model including psychosocial work characteristics poorly discriminated (AUC=0.65; 95% CI 0.56–0.74) between workers with and without mental LTSA.

Conclusions
Feedback about one's performance is associated with lower rates of mental LTSA, but it is not useful to measure psychosocial work characteristics to identify workers at risk of mental LTSA.

Introduction

About 15% of the working population in countries belonging to the Organization of Economic Cooperation and Development (OECD) experience mental health problems and another 5% suffers severe mental illness [1]. The mental health expenditures are rising, and now represent 5-18% of the total health expenditures of OECD countries. Albeit less productive, most workers with mental health problems stay at work [1,2]. They report sick when they experience difficulties in meeting the cognitive and emotional demands of work. It is estimated that the costs of sickness absence due to mental disorders are 3-4% of a country's gross national product [2]. For people with a sickness absence from work due to a mental disorder a median duration of 99 days was reported during 2-year follow-up of Dutch workers [3] and a median sickness absence duration of 147 days was reported during 1-year follow-up of Danish workers [4]. Long-term sickness absence (LTSA) separates workers from the workplace and may ultimately lead to withdrawal from the labor market into states of disability or unemployment, which may further deteriorate mental health [5].

There is a large body of evidence that psychosocial work characteristics are associated with mental health [6]. Most studies have used the Demand – Control (D-C) model as conceptual framework to investigate psychosocial work characteristics in relation to LTSA. The D-C model poses that job strain arises when psychological job demands are high and job control low [7]. However, the D-C model fails to capture the complexity of today's work environments. The Job Demands – Resources (JD-R) model goes beyond the D-C model and proposes that job strain can result from exposure to any job demands (i.e., those aspects of the job that require physical and/or psychological effort) and job resources (i.e., those aspects of the job that help to achieve goals and stimulate personal development), not only psychological job demands and job control [8,9].

Several studies have used the JD-R model as a framework for investigating the relationship between psychosocial work characteristics and LTSA. In a study of 3,092 Dutch home care workers, psychosocial work characteristics were investigated measuring workers' perceptions by questionnaire. High physical, emotional, and psychological job demands, problems with planning, and unwanted intimacies or physical threatening by patients were related to long sickness absence duration [10]. Alternatively, worker-reported skill discretion, decision authority, social support, professional development, coaching by supervisor, feedback about one's performance, and financial rewards were related to a high sickness absence frequency. In a study of 201 Dutch managers, Schaufeli et al. [11] reported that increasing perceived workload, emotional demands, and work-home interference were associated with a longer duration of sickness absence. Decreasing social support, autonomy, opportunities to learn, and feedback about one's performance were associated with a higher frequency of sickness absence. In a Danish study among 39,408 workers employed in various occupations, workers who reported a high work pace, high quantitative demands, low influence at work, and poor leadership quality had a higher LTSA risk [12].

The aforementioned studies investigated associations between worker-reported psychosocial work characteristics and LTSA irrespective of diagnosis. Reviews on work and mental health have provided evidence that perceived psychosocial work characteristics are associated with the onset of mental disorders [13]. Given the fact that mental disorders are a major cause of LTSA and given the consequences of mental LTSA for employers (productivity

loss and LTSA compensation costs) and workers (reduced labor market participation), it would be interesting to know if worker-reported psychosocial work characteristics are predictive of mental LTSA. We used the JD-R model as a theoretical framework to answer the following research questions:

I) Which worker-reported psychosocial work characteristics are prospectively associated with mental LTSA?

II) Do these worker-reported psychosocial work characteristics identify workers at risk of mental LTSA?

Methods

Study population and design

In The Netherlands employers are obliged to offer a health survey to their personnel every four years. The present study used the data of 4,877 workers employed in the distribution and transport sector, who participated in a health survey in November 2010. They received a mailed questionnaire measuring health-related variables and psychosocial work characteristics. For workers, participation in health surveys is voluntary; a total of 4,018 (82%) non-sicklisted workers participated in the health survey and returned the questionnaire. Sickness absence data were retrieved from an occupational health register in the period between January 1st 2011 to December 31st 2012; 1,236 workers had to be excluded because sickness absence data were not available (n=258) or incomplete (n=978). Consequently, 2,782 (57%) workers were included in the analyses. The Medical Ethics Committee of the University Medical Center Groningen granted ethical clearance for this study.

Baseline variables

The health survey questionnaire asked for age (in years), gender (male, female), education (primary school and lower vocational education = low; secondary general or vocational education = middle; higher vocational and academic education = high), job type (chauffeurs and postmen = manual workers transport; post sorters = manual workers distribution; supervisor/manager; others e.g., post collectors and weekend workers, predominantly students), duration of employment at present company (in years), duration of employment in the present job (i.e., job tenure in years), and the average number of work hours per week.

Baseline mental health was assessed with the 16-item distress scale of the Four-Dimensional Symptom Questionnaire (14), which measures symptoms elicited by stressors or the efforts to maintain psychosocial functioning (e.g., worrying, irritability, tension, listlessness, poor concentration, sleeping problems and demoralization). Workers were asked if they experienced these symptoms in the past week, 'no' (=0), 'sometimes' (=1), 'regularly' (=2), 'often' (=2), or 'very often/constantly' (=2); item scores were summed (score range 0–32; Cronbach's α=0.94) so that higher scores reflected higher levels of distress.

Psychosocial work characteristics

Workload (11 items; α=0.90), workpace (7 items; α=0.66), variety in work (6 items; α=0.86), autonomy in work (3 items; α=0.81), participation in decisions about work (6 items; α=0.91), learning opportunities (4 items; α=0.90), receipt of feedback about one's performance (3 items; α=0.87), and support from supervisor (5 items; α=0.94) and co-workers (3 items; α=0.91) were measured with the Questionnaire on the Experience and Evaluation of Work (15). Workers could respond on a four-point frequency scale ranging from "never" (=1) to "always" (=4) and item scores were summed to scale scores, so that higher scores represented higher levels of the working condition measured. For comparability, all scale scores were expressed as percentage of the maximum scale score (range 0 – 100).

Changes in work were assessed with 6 questions about changes in work tasks (e.g., How often did the contents of your work change in the past year?), team (e.g., How often did the team staffing change in the past year?), and organization (e.g., How often did changes in

organizational policies occur in the past year?). Responses were given on 5-point frequency scales ranging from "never" to "often/always" and summed (α=0.84) so that higher scores represented more frequent changes. The scale score was expressed as percentage of the maximum scale score (range 0 – 100).

Long-term sickness absence (LTSA)

The International Classification of Functioning, Disability and Health (ICF) recognizes that disability is the result of the interaction between body functions, body structures, activities, participation, and contextual demands [16]. In line with the ICF model, we defined sickness absence as a temporary paid leave from work due to incapacity to meet the demands of work as a result of injury or illness. Sickness absence was recorded from the first to the last sickness absence day in an occupational health register. In The Netherlands, sickness absence is medically certified by an occupational physician (OP) with a diagnostic code derived from the 10th International Classification of Diseases (ICD-10) within 42 days of reporting sick. Therefore, LTSA was defined as sickness absence lasting 42 days or longer. Mental LTSA was defined as LTSA OP-certified within ICD-10 chapter F (Mental and Behavioral Disorders).

Statistical analysis

Statistical analyses were done in IBM SPSS Statistics for Windows, version 23 (released 2015; IBM Corp. Armonk, NY). First, we investigated prospective associations between each of the worker-reported psychosocial work characteristics and the occurrence (no=0, yes=1) of mental LTSA in the period from January 1st 2011 to December 31st 2012 by using logistic regression analyses. The associations were adjusted for sociodemographics (age, gender, and educational level), work factors (job type, duration of employment, job tenure, and work hours/week), and baseline mental health.

Then, all perceived psychosocial work characteristics were included together in a logistic regression model for mental LTSA, which was then reduced by stepwise backward selection procedure, adhering to Akaike's Information Criterion (AIC) as stopping rule [17]. For the final model, we used receiver operating characteristic (ROC) analysis to investigate the ability of the reduced models to discriminate between workers with and without (mental) LTSA during 2-year follow-up. The area under the ROC-curve (AUC) was considered as measure for the discriminative ability; AUC<0.60 represents failing, 0.60 – 0.69 poor, 0.70 – 0.79 fair, 0.80 – 0.89 good, and 0.90 – 1.00 perfect discrimination [18]. The AUC is indicative of the percentage of correctly identified workers with mental LTSA during follow-up.

For comparison, the same analyses were performed for all OP-certified LTSA episodes, excluding sick leaves due to pregnancy, childbirth and puerperium (ICD-10 chapter XV).

Results

The 1,236 workers excluded from analysis because of unavailable or incomplete sickness absence data were younger, more often male, had a shorter employment duration, shorter job tenure, and reported more favorable psychosocial work characteristics than the 2,782 workers included in complete cases analysis (Table 1).

Table 1 Study population characteristics (N=4018).

		Included in complete cases analyses (n=2782)		Excluded because of missing data (n=1236)		Analysis
		Mean (SD)[a]	N (%)	Mean (SD)[a]	N (%)	
Age (in years)		49.9 (9.5)		34.1 (14.9)		*P*<0.01[b]
Gender	men		1235 (44)		609 (49)	*P*<0.01[c]
	women		1547 (56)		627 (51)	
Educational level	low		1460 (52)		648 (52)	*P*=0.96[c]
	middle		1038 (37)		459 (37)	
	high		284 (11)		129 (11)	
Job type	manual worker transport		1046 (38)		1083 (88)	*P*<0.01[c]
	manual worker distribution		1455 (52)		64 (5)	
	supervisor/manager		150 (5)		8 (1)	
	other		131 (5)		81 (6)	
Duration employment	<1 year		142 (5)		130 (11)	*P*=0.01
	1-5 years		537 (19)		286 (23)	
	5-10 years		275 (10)		98 (8)	
	10-20 years		682 (25)		298 (24)	
	>20 years		1146 (41)		424 (34)	
Job tenure (in years)		12.8 (11.4)		11.6 (10.7)		*P*=0.03
Work hours per week		22.4 (12.2)		10.6 (7.4)		*P*<0.01[d]
Mental health (range 0-32)		9.8 (9.0)		8.3 (8.4)		P<0.01[d]
Psychosocial work characteristics (range 0-100)						
	workload	44.9 (20.4)		42.5 (19.7)		P=0.04[d]
	workpace	39.6 (18.7)		38.0 (17.9)		P=0.16[d]
	changes in work	32.0 (19.2)		31.6 (18.8)		P=0.63[d]
	variety in work	33.2 (22.3)		37.4 (24.5)		P<0.01[d]
	autonomy in work	40.1 (27.7)		44.8 (28.3)		P<0.01[d]
	participation in decisions about work	24.4 (20.4)		29.4 (23.9)		P<0.01[d]
	learning opportunities	15.3 (19.7)		20.8 (23.8)		P<0.01[d]
	feedback about one's performance	41.0 (25.1)		47.5 (26.6)		P<0.01[d]
	support from the supervisor	48.1 (27.2)		54.1 (26.7)		P<0.01[d]
	support from co-workers	53.5 (26.2)		58.8 (25.1)		P<0.01[d]

standard deviation

parametric t-test for independent samples

Chi-square test

non-parametric Mann-Whitney test for independent samples

Associations between perceived psychosocial work characteristics and mental LTSA

A total of 73 (3%) workers had mental LTSA during 2-year follow-up: 37 (52%) were diagnosed with anxiety, stress-related, and somatoform disorders (ICD-10 F40-49), 17 (23%) symptoms and signs of emotional disturbance (R45),14 (19%) mood disorders (F30-39), and 5 (6%) psychotic disorders (F20-29). Higher levels of perceived feedback about one's performance was associated with lower odds of mental LTSA, but associations became non-significant after adjustment for work factors and baseline mental health (Table 2). The other psychosocial work characteristics were not significantly associated with mental LTSA during 2-year follow-up.

Table 2 Psychosocial work characteristics and long-term sickness absence (LTSA) due to mental disorders.
The table shows odds ratios (95% confidence intervals) per 10-point increase in standardized scores (range 0–100) for each work characteristic (unadjusted), adjusted for sociodemographics (age, gender, and educational level), work factors (job type, duration of employment, job tenure, and work hours/week), and baseline mental health.

Work characteristic	Unadjusted	Adjusted for:		
		sociodemographics	work factors	mental health
Workload	1.08 (0.91 – 1.29)	1.03 (0.85 – 1.25)	0.98 (0.79 – 1.22)	0.89 (0.73 – 1.08)
Workpace	1.04 (0.87 – 1.24)	0.96 (0.81 – 1.15)	0.87 (0.71 – 1.06)	0.80 (0.66 – 0.98)*
Changes in work	1.14 (0.97 – 1.33)	1.11 (0.93 – 1.32)	1.06 (0.87 – 1.29)	0.97 (0.81 – 1.16)
Variety in work	0.97 (0.83 – 1.14)	0.96 (0.82 – 1.12)	0.99 (0.83 – 1.18)	1.02 (0.87 – 1.19)
Autonomy in work	0.89 (0.77 – 1.02)	0.91 (0.80 – 1.05)	0.96 (0.84 – 1.10)	0.95 (0.83 – 1.09)
Participation in decisions about work	0.84 (0.69 – 1.03)	0.88 (0.72 – 1.07)	0.92 (0.74 – 1.14)	0.91 (0.75 – 1.11)
Learning opportunities	0.79 (0.62 – 1.00)	0.83 (0.65 – 1.05)	0.90 (0.70 – 1.17)	0.84 (0.67 – 1.07)
Feedback about one's performance	0.82 (0.70 – 0.96)**	0.84 (0.71 – 0.98)*	0.88 (0.74 – 1.05)	0.89 (0.76 – 1.04)
Support from the supervisor	0.89 (0.77 – 1.02)	0.93 (0.81 – 1.07)	0.98 (0.85 – 1.12)	1.00 (0.87 – 1.15)
Support from co-workers	0.95 (0.83 – 1.09)	0.97 (0.85 – 1.11)	1.01 (0.88 – 1.16)	1.03 (0.90 – 1.18)

* significant at the 5% level and ** significant at the 1% level

Associations between perceived psychosocial work characteristics and all-cause LTSA

A total of 393 (14%) workers had all-cause LTSA during 2-year follow-up. Higher workload and higher workpace were associated with higher odds of all-cause LTSA, whereas more learning opportunities, more feedback about one's performance, and more support from the supervisor were associated with lower odds of all-cause LTSA (Table 3). The associations weakened after adjustment for sociodemographics, but remained significant for learning opportunities, feedback about one's performance, and supervisor support. After adjustment for work factors and baseline mental health, only feedback about one's performance was significantly associated with all-cause LTSA.

Table 3 Psychosocial work characteristics and all-cause long-term sickness absence (LTSA).
The table shows odds ratios (95% confidence intervals) per 10-point increase in standardized scores (range 0–100) for each work characteristic (unadjusted), adjusted for sociodemographics (age, gender, and educational level), work factors (job type, duration of employment, job tenure, and work hours/week), and baseline mental health.

Work characteristic	Unadjusted	Adjusted for:		
		sociodemographics	work factors	mental health
Workload	1.07 (1.01 – 1.14)*	1.03 (0.95 – 1.11)	0.99 (0.92 – 1.07)	1.04 (0.98 – 1.10)
Workpace	1.09 (1.03 – 1.16)**	1.05 (0.99 – 1.11)	1.01 (0.95 – 1.07)	1.05 (0.99 – 1.11)
Changes in work	1.04 (0.98 – 1.10)	1.03 (0.97 – 1.09)	0.98 (0.91 – 1.06)	1.00 (0.94 – 1.06)
Variety in work	0.97 (0.93 – 1.01)	0.97 (0.92 – 1.03)	0.99 (0.93 – 1.05)	0.99 (0.93 – 1.05)
Autonomy in work	0.96 (0.92 – 1.00)	0.98 (0.94 – 1.02)	1.00 (0.96 – 1.04)	0.97 (0.92 – 1.03)
Participation in decisions about work	0.94 (0.89 – 1.00)	0.95 (0.90 – 1.01)	0.96 (0.91 – 1.02)	0.95 (0.90 – 1.01)
Learning opportunities	0.90 (0.84 – 0.95)**	0.91 (0.86 – 0.97)**	0.92 (0.85 – 1.00)	0.91 (0.86 – 1.00)
Feedback about one's performance	0.92 (0.89 – 0.96)**	0.90 (0.85 – 0.95)**	0.92 (0.87 – 0.98)**	0.94 (0.91 – 0.98)**
Support from the supervisor	0.94 (0.91 – 0.98)**	0.95 (0.91 – 0.99)*	0.98 (0.94 – 1.02)	0.96 (0.92 – 1.00)
Support from co-workers	0.97 (0.93 – 1.01)	0.98 (0.94 – 1.02)	1.00 (0.96 – 1.04)	0.99 (0.95 – 1.03)

* significant at the 5% level and ** significant at the 1% level

Identifying workers at risk of mental LTSA

When all worker-reported psychosocial work characteristics were included together in logistic regression analysis, learning opportunities had the highest Wald-statistic, indicating that this was the strongest predictor of mental LTSA (Table 4). In seven backward steps, participation in decisions about work, workload, support from supervisor and colleagues, autonomy, workpace, and changes in work were removed from the model. The remaining model (including variety in work, feedback about one's performance, and learning opportunities) poorly identified workers with mental LTSA during follow-up (AUC=0.65; 95% CI 0.56–0.74).

With regard to all-cause LTSA, perceived support from supervisor and autonomy were removed from the logistic regression model. The final model (including workload, workpace, changes in work, variety in work, participation in decisions about work, learning opportunities, feedback about one's performance, and support from colleagues) did not identify workers with all-cause LTSA during follow-up (AUC=0.59; 95% CI 0.56 – 0.62).

Table 4 Multivariable models of psychosocial work characteristics.
The table shows odds ratios (OR) and 95% confidence intervals (CI) per 10-point increase in standardized scores (range 0–100) when all work characteristics are included together in a logistic regression model for long-term sickness absence (LTSA) due to mental disorders (mental LTSA) or LTSA irrespective of diagnosis (all-cause LTSA); higher Wald statistics reflect stronger predictive ability.

Work characteristic	Mental LTSA		All-cause LTSA	
	OR (95% CI)	Wald	OR (95% CI)	Wald
Workload	0.98 (0.75 – 1.29)	0.014	1.02 (0.92 – 1.13)	0.236
Workpace	0.90 (0.70 – 1.17)	0.682	1.06 (0.98 – 1.15)	2.166
Changes in work	1.13 (0.91 – 1.40)	1.301	0.98 (0.91 – 1.06)	0.406
Variety in work	1.15 (0.95 – 1.40)	2.001	1.06 (1.00 – 1.13)	3.008
Autonomy in work	0.91 (0.77 – 1.09)	1.054	1.00 (0.94 – 1.06)	0.009
Participation in decisions about work	1.00 (0.75 – 1.34)	0.001	1.03 (0.93 – 1.14)	0.406
Learning opportunities	0.83 (0.60 – 1.13)	1.509	0.88 (0.81 – 0.95)	8.147
Feedback about one's performance	0.86 (0.71 – 1.05)	2.126	0.94 (0.89 – 1.00)	3.078
Support from the supervisor	0.98 (0.82 – 1.17)	0.053	1.00 (0.94 – 1.06)	0.002
Support from co-workers	1.04 (0.91 – 1.19)	0.302	1.02 (0.96 – 1.08)	0.446

Discussion

Higher levels of worker-reported feedback about one's performance were significantly associated with a lower mental LTSA risk during 2-year follow-up of workers employed in the distribution and transport sector. Higher workload and higher workpace were associated with a higher risk of all-cause LTSA. Alternatively, more learning opportunities, more feedback about one's performance, and more support from the supervisor were associated with a lower risk of all-cause LTSA. Associations between psychosocial work characteristics and both mental and all-cause LTSA weakened after adjusting the analyses for work factors (job type, duration of employment, job tenure, and work hours/week) and baseline mental health. The results of the study should be interpreted with caution, because we investigated many associations and only found a weak relationship between feedback about one's performance and mental LTSA. Although associations were significant for some psychosocial work characteristics, the overall predictive strength of a prediction model including worker-reported psychosocial work characteristics was not great.

Perceived psychosocial work characteristics and mental LTSA

The relationship between worker-reported psychosocial work characteristics and mental LTSA was studied by using the JD-R model as a theoretical framework. We found that more feedback about one's performance was associated with a lower mental LTSA risk. Previously, Bakker , Demerouti & Schaufeli [19] have reported that more feedback about one's performance was associated with fewer mental health problems, particularly exhaustion among call centre workers. In addition more feedback about one's performance was related to more work involvement and a lower turnover intention. More feedback about one's performance may increase work motivation and stimulate personal development. Furthermore more feedback about one's performance may contribute to more work efficiency and thus facilitate reaching work goals.

It was unexpected that higher workload (e.g., does your work demand a lot of concentration, precision, attention, thought, carefulness) and workpace (e.g., do you have to hurry, work fast, work under time pressure) were not significantly related to mental LTSA. The literature on associations between psychosocial work characteristics and mental LTSA is scarce. One cross-sectional study reported that quantitative demands and role conflicts were positively correlated with mental LTSA among workers employed at a Swedish county council [20]. Our different findings may be due to differences in study population and study design. Furthermore, we measured psychosocial work characteristics with other instruments than those used by Wännström and colleagues.

The prospective associations between perceived psychosocial work characteristics and mental LTSA weakened after adjustment for baseline mental health. This is most likely due to the fact that mental health mediates between psychosocial work characteristics and mental LTSA: unfavorable work characteristics -> poor mental health -> mental LTSA. However, adjustment for mental LTSA also weakened the associations between psychosocial work characteristics and all-cause LTSA. This could indicate that workers who experience poor mental health (i.e., higher distress levels) perceive work characteristics more negatively than healthy workers [21,22].

The finding that most worker-reported psychosocial work characteristics were not

significantly associated with mental LTSA could also be explained by the fact that stressful events rather than unfavorable work characteristics cause mental LTSA. In that regard, it is important to acknowledge that most workers with mental LTSA were diagnosed with adjustment disorders, i.e.: difficulties adjusting to major changes created by life events at the workplace (e.g., change of work or job loss) and/or in private life (e.g., divorce, disease or death of relatives and financial problems). Maladaptive reactions to stressful life events and resulting adjustment disorders impair social and occupational functioning. In The Netherlands, workers diagnosed with adjustment disorders due to stressful events in private life are also allowed a paid leave off work due to sickness if they are unable to meet the demands of work. Sickness absence due to adjustment disorders is the major cause of mental LTSA in The Netherlands [3].

Perceived psychosocial work characteristics and all-cause LTSA

For comparability of the present results with those of previous studies, we investigated the relationship between worker-reported psychosocial work characteristics and all-cause LTSA. In agreement with studies that used the JD-R model as theoretical framework [10-12], we found that a higher workload and higher workpace were associated with a higher risk of all-cause LTSA. The associations weakened, however, after adjustment for sociodemographics and work factors. For high work pace, Clausen et al. [12] have shown an increased risk of all-cause LTSA among employees working with customers, but not among white and blue collar workers. Furthermore, the association between workpace and all-cause LTSA became non-significant after mutual adjustment for work factors.

We also found that higher levels of learning opportunities, feedback about one's performance, and more support from the supervisor buffered against all-cause LTSA. Previously, Clausen et al. [12] reported strong associations between job resources, particularly influence at work and the risk of all-cause LTSA. The authors discussed the importance of job resources for adapting to and coping with the stresses and strains experienced in the work situation. For instance, it may be easier to cope with high job demands, if workers experience good relations with their supervisor and receive more feedback about how they perform their work than if workers do not harbor positive emotions towards work [23].

The associations between perceived psychosocial work characteristics and LTSA weakened after adjustment for work factors, particularly the duration of employment and to a lesser extent job tenure [data not shown]. Obviously, the risk of LTSA depends on both the level and the duration of exposure to psychosocial work characteristics. Independent of the duration of exposure, only more feedback about one's performance was significantly associated with the risk of LTSA.

Unexpectedly, we found more psychosocial work characteristics to predict LTSA for all causes than LTSA for mental disorders. One explanation may be that the results were biased by diagnostic misclassification. O'Niell et al. [24] reported that the agreement between OPs and psychiatrists for certifying LTSA was better for specific mental diagnoses such as depression and anxiety disorders, than for non-specific stress-related disorders. OPs may have certified sickness absence within the ICD-10 chapter XVIII of symptoms and signs not elsewhere classified if workers presented with non-specific symptoms such as headache or tiredness. Also, workers presenting with psychosomatic symptoms could have been misclassified as having a musculoskeletal or other somatic disorder. Thus, the OP-diagnoses

may have been biased by non-recognition. However, using OP-diagnosed mental LTSA is better than relying on worker-reported mental illness.

The finding that more psychosocial work characteristics are associated with all-cause LTSA may also be explained from a statistical viewpoint. There were more all-cause LTSA events, and therefore estimations of regression coefficients were more precise. For example, the association of workload with mental LTSA was of the same magnitude (OR=1.08) as the association with all-cause LTSA (OR=1.07), but the estimate for all-cause LTSA was more precise as was reflected in a narrower 95% CI. Due to the greater statistical power, the association between workload and all-cause LTSA was significant while the association between workload and mental LTSA was not significant.

Strengths and weaknesses

The prospective study design and the use of recorded LTSA data and OP-diagnoses are strengths of the current study, but some weaknesses should be mentioned. First, the response rate was high (82%), but we had to exclude 1,236 (31%) responders because their sickness absence data were not available or incomplete. The excluded workers were younger, had shorter employment duration and job tenure, worked less hours/week, and generally reported more favorable psychosocial work characteristics than the workers included in the analyses. Another limitation is the low number of mental LTSA episodes. The associations between psychosocial work characteristics and mental LTSA were of the same magnitude as the associations with all-cause LTSA, but the 95% confidence intervals were wider due to the low number of mental LTSA episodes.

The present study measured psychosocial work characteristics with self-administered questionnaires. Using worker-reported data is a convenient way to collect a information from a large number of workers. Furthermore, workers are those who know and experience their work environment. These advantages must be balanced against one major disadvantage that workers' responses are not only driven by the characteristics of work, but also by other factors, such as personal dispositions, mood, expectations, previous experiences, or health [25]. Such 'worker-report bias' might have caused under- and overestimations of associations between psychosocial work characteristics and mental LTSA. Previously, Persson and Kristiansen [26] argued that worker-reported psychosocial work characteristics should not be interpreted as actual work environmental exposures. For this study, the precise measurement of actual psychosocial work characteristics was of lesser concern because we were interested in mental LTSA predictions based on how workers perceive and appraise their work. However, we could not rule out that workers with mental illness filled in the health survey questionnaire in a state-dependent manner. For example, workers with depressive symptoms may perceive and appraise their work more negatively than those without depressive symptoms. This type of information bias over-estimates the associations between psychosocial work characteristics and mental LTSA [22].

Finally, we did not adjust for all psychosocial work characteristics and all potential confounders. Such an analysis would have been possible for all-cause LTSA, but for mental LTSA a multivariable logistic regression model including all work characteristics, sociodemographics, work factors, and baseline mental health resulted in statistical overfitting [data not shown]. Therefore, we adjusted for sociodemographics, work factors, and baseline mental health in separate logistic regression models.

Implications for practice and suggestions for further research

In univariate analysis, perceived feedback about one's performance was prospectively associated with (mental) LTSA. Supervisors and managers might be able to reduce (mental) LTSA by giving information about the purpose and results of the work, and by telling how well workers do their work. However, according to the JD-R model, associations between worker-reported work characteristics and (mental) health outcomes differ across workplaces. The heterogeneity reported by Stansfeld and Candy [6] in their systematic review and meta-analysis of psychosocial work characteristics and mental health supports this JD-R statement. Therefore, more feedback about one's performance may not be the cue for managing (mental) LTSA in other workplace settings. Supervisors should consider measuring psychosocial work characteristics to get insight in the job demands and resources in their department.

The present results showed that worker-reported psychosocial work characteristics poorly discriminated between initially non-sicklisted workers with and without incident mental LTSA during a 2-year follow-up period. An AUC of 0.65 indicates that for any random pair of workers, the prediction model correctly assigns the highest risk to the worker with mental LTSA in 65% of the cases. Based on this poor discriminative ability and the aforementioned heterogeneity of associations between psychosocial work characteristics and mental health, we conclude that it would not be useful to include psychosocial work characteristics in a tool for identifying workers at increased risk of mental LTSA. The QEEW measures perceived psychosocial work characteristics, but not the importance workers accredit to these characteristics. It is conceivable that work characteristics have more impact on mental health if they are valued important by a given worker employed in a given workplace setting. Abma et al. [27] developed a capability set for work questionnaire, which measures the valued aspects of work and incorporates whether a worker is able to achieve what (s)he values in his/her work. It would be interesting to investigate if the capability set for work questionnaire better than the QEEW identifies workers at risk of mental LTSA.

Conclusions

More perceived feedback about one's performance was associated with lower risks of (mental) LTSA among workers in the distribution and transport sector. The other worker-reported psychosocial work characteristics were not related to mental LTSA. A prediction model including psychosocial work characteristics poorly discriminated between workers with and without mental LTSA during 2-year follow-up. Based on these results, we conclude that it is not useful to measure psychosocial work characteristics for the purpose of case-finding workers at risk of mental LTSA.

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Chapter 7

Distress, work satisfaction, and work ability are mediators of the relation between psychosocial working conditions and mental health-related long-term sickness absence.

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Abstract

Objective
This study investigated the effects of psychosocial working conditions on mental health-related long-term sickness absence and whether distress, work satisfaction, burnout, engagement, and work ability mediated the associations between psychosocial working conditions and mental health-related long-term sickness absence.

Methods
This cohort study included 53,833 non-sick listed workers who participated in occupational health surveys between 2010 and 2013. The effects of the individual psychosocial working conditions on mental long-term sickness absence were analyzed using univariable and multivariable logistic regression analyses. Mediation analyses were performed to examine the mediating role of distress, burnout, work satisfaction, engagement, and work ability between psychosocial working conditions and mental long-term sickness absence. The mediation analyses were performed using structural equation modeling.

Results
Role clarity, cognitive demands, emotional demands, work variety, learning opportunities, co-worker support, and social support from family and friends were related to mental health-related long-term sickness absence after adjustment for other working conditions. The relationship between emotional demands and mental health-related long-term sickness absence was the strongest, OR 1.304 ($p < 0.001$, 95 % CI 1.135 to 1.498). The relation between psychosocial working conditions and mental health-related long-term sickness absence was mediated by distress, work satisfaction and work ability. Distress was the most important mediator between psychosocial working conditions and mental health-related long-term sickness absence.

Conclusions
Psychosocial working conditions are related to mental health-related long-term sickness absence. After correction for other working conditions, the association between emotional demands and mental health-related long-term sickness absence was the strongest. Psychosocial working conditions are indirectly related to mental health-related long-term sickness absence through mediation by distress, work satisfaction, and work ability.

Introduction

Mental health problems are the most important and increasing cause of long-term sickness absence (LTSA) of the workforce. The Organization of Economic Cooperation and Development (OECD) reported in 2015 that 30 to 40 % of the sickness absence and work disability cases in western societies were related to mental illness [(1)]. LTSA disengages workers from the workplace and the probability of resuming work decreases with increasing LTSA duration. LTSA due to a mental illness has a median duration of 231 days (data of HumanTotalCare, The Netherlands 2018). To prevent mental health-related LTSA, it is important to identify the causal mechanisms underlying mental health-related LTSA.

There is evidence that psychosocial working conditions are associated with mental health-related LTSA [(2,3)]. The psychosocial working conditions are formed by a combination of job demands (e.g. work pace, cognitive demands, emotional demands, work-family interference) and job resources (e.g. role clarity, variety in work, learning opportunities, support from supervisor, co-workers, family and friends). Our study is based on the Job Demands-Resources (JD-R) model, which is one of the theoretical models looking at the relationship between psychosocial work factors and mental health and sickness absence. The JD-R model describes that adverse psychosocial working conditions lead to emotional exhaustion and burnout if the efforts to meet job demands are too high or if there is insufficient time to recover from the demands, i.e. the exhaustion process [(4)]. On the other hand, high job resources enable coping with job demands, to achieve goals, stimulate personal growth and lead to work satisfaction. i.e. the motivational process [(5-7)].

Previous research has shown that adverse psychosocial working conditions lead to distress (8-1)} and that sustained distress leads to mental health-related LTSA [(14,15)]. It is therefore expected that distress will mediate the relation between psychosocial working conditions and mental health-related LTSA.

There is also evidence of an association between psychosocial working conditions and burnout. Schaufeli et al [(16)] found a relation between high work pace, high emotional demands, high work family interference and higher burnout. Fagerlind Ståhl et al [(17)] showed that high demands such as work pace, workload and conflicting demands at work were associated with greater risk of burnout. Burnout in turn is associated with a higher risk of sickness absence [(18)].

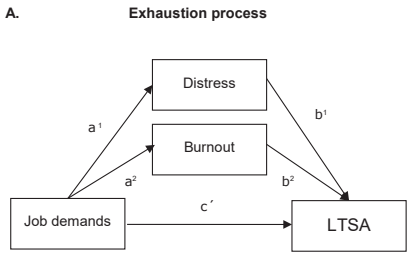
Several studies described associations between psychosocial working conditions and work satisfaction. High work pace was found to be related to low job satisfaction [(13.16)], whereas de Jonge [(19)] showed a relation between high emotional demands and low work satisfaction. Furthermore, low work satisfaction was associated with higher sickness absence by Laaksonen M et al [(20)].

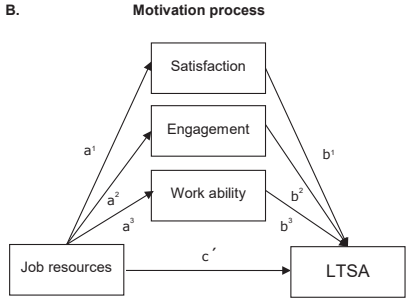
There is consistent evidence of an association between challenging job demands combined with high job resources and high engagement [(4,21)]. Low engagement was found to be associated with high sickness absence [(22)].

Finally, work ability, is also expected to be a mediator between psychosocial working conditions and mental health-related LTSA since work ability includes a component related to mental capability to perform at work [(23)]. Previous research showed that psychosocial working conditions were related to work ability [(24,25)] and work ability was found to be related to mental health-related LTSA [(26)].

The aforementioned associations have only been investigated individually and mostly without mental health-related LTSA data hence a cohesive understanding of the causal mechanisms in the relation between psychosocial working conditions and mental health-related LTSA is still lacking. The current study therefore investigates these associations using mediation analyses. Figure 1 shows our hypothesized mediation model. In figure 1 c' reflects the direct paths and the indirect paths are reflected by the products of a and b.

Figure 1 Multiple mediator models.
The model in panel A was corrected for job resources
The model in panel B was adjusted for job demands





The aim of this study was to investigate the total, direct and indirect effect of psychosocial working conditions on mental health-related LTSA. We investigated if distress, burnout, work satisfaction, engagement, and work ability mediated the associations between psychosocial working conditions and mental health-related LTSA.

Methods

Study population and design
For this study, we used the data of 53,833 workers who participated in occupational health surveys in The Netherlands between 2010 and 2013. According to the Dutch Labor Law, companies have to enable their employees to participate in a voluntary occupational health survey once every four years. Occupational health surveys are conducted by occupational health services (OHS) and consist of an online occupational health questionnaire. The questionnaire commonly addresses physical and mental workload, psychosocial work environment, working conditions and health complaints. The study was set up as a prospective cohort study with the occupational health survey measured at baseline and sickness absence recorded in the year following the occupational health survey at follow-up. Participants with more than 25 % missing responses or on sickness absence at baseline were excluded from our study, leaving the data of 31,884 non-sick-listed (57%) participants for complete case analyses. Participants with complete data did not differ from excluded participants in age, gender, education and years employed at the company. Missing data were therefore assumed to be completely at random. The Medical Ethics Committee of the University Medical Center Groningen reviewed the study and granted ethical approval.

Outcome: long-term sickness absence (LTSA)
Sickness absence was defined as a temporary paid leave from work due to any (i.e., work-related as well as non-work-related) injury or illness, and was recorded from the first to the last sickness absence day in an occupational health service (OHS) register. In The Netherlands, sickness absence is medically certified by an occupational physician (OP) within 42 days of reporting sick. Therefore, LTSA was defined as sickness absence lasting 42 days or longer.

Based on a consultation with a sick-listed worker, the OP records a diagnostic code derived from the 10th International Classification of Diseases (ICD-10) in the OHS register. Mental health-related LTSA was defined as LTSA with diagnostic codes of the ICD-10 chapter V (Mental and Behavioral Disorders). Mental health-related LTSA during 1-year follow-up was used as the dichotomous outcome variable. The exposed group was the group with mental LTSA, while the workers without sickness absence lasting 42 days or longer or any other diagnosis comprised the reference group.

Independent variables
Psychosocial working conditions
The job demands, work pace (5 items, Cronbach's α=0.87), cognitive demands (5 items, α=0.82), emotional demands (3 items, α=0.80), and job resources, variety in work (6 items; α=0.86), role clarity (5 items; α=0.85), learning opportunities (4 items; α=0.87), supervisor support (3 items; α=0.90), and co-worker support (3 items; α=0.88), were measured with the Questionnaire on the Experience and Evaluation of Work [27]. Survey participants responded on a five-point frequency scale ranging from 1 (i.e. 'never') to 5 (i.e. 'always') and item scores were summed to a total subscale score, which was then divided by the number of items of that subscale. Consequently, all psychosocial working characteristics consisted of a score ranging between 1 (i.e. low) and 5 (i.e. high).

The job demand work – family interference was assessed with 7 items (e.g., "How often

does your job interfere with responsibilities at home?", "How often does your job prevent you from spending time with family and friends?" α=0.88). Responses were given on 5-point frequency scales ranging from 'never' (i.e. 1) to 'always' (i.e. 5); item scores were summed and averaged so that work family interference ranged between 1 (i.e low) and 5 (i.e. high).

Mediators:

Distress was measured with the Four-Dimensional Symptom Questionnaire (4DSQ), which was included in the occupational health survey questionnaire. The distress scale consisted of 16 items addressing symptoms elicited by stressors or the efforts to maintain psychosocial functioning, e.g., worry, irritability, tension, listlessness, poor concentration, sleeping problems, and demoralization [28.29]. Survey participants were asked if they had experienced these symptoms in the past week, 'no' (i.e 0), 'sometimes' (i.e 1), 'regularly' (i.e. 2), 'often' (i.e. 2), or 'very often/constantly' (i.e. 2). Item scores were summed (score range 0–32; Cronbach's α=0.94), so that higher scores reflected higher levels of distress. Terluin et al. (30) defined scores ≤10 as low, 11-20 as moderate, and >20 as high distress.

Burnout was measured with the 15-item Dutch version of the Maslach Burnout Inventory – General Scale [31]. Items were scored on a 6-point frequency scale, summed and averaged into a burnout score between 0 (i.e low) and 6 (i.e. high).

Work satisfaction was measured with 6 items (α=0.87) about pleasure in work (e.g., "I am pleased to start my day's work", "I find my work stimulating", "I enjoy my work"). Responses were given on a 5-point frequency scale ranging from 'never' (i.e. 1) to 'always' (i.e. 5). Items scores were summed and averaged, so that work satisfaction ranged between 1 (i.e. low) and 5 (i.e. high).

Work engagement was measured with a 9-item short form of the Utrecht Work Engagement Scale [32]. The items were scored on a 6-point frequency scale ranging from 'never' (=0), 'scarcely' (=1), 'sometimes' (=2), 'regularly' (=3), 'often' (=4), 'very often' (=5), and 'always' (=6). The item scores were summed and averaged to a work engagement score between 0 (i.e. low) and 6 (i.e. high).

Work ability was measured with a shortened version of the Work Ability Index (WAI) covering items on current work ability compared with lifetime best work ability in relation to the (physical and mental) demands of work, number of physician-diagnosed diseases, impaired work performance due to illness, sickness absence in the past 12 months, expected work ability in the forthcoming two years, and mental resources [33]. The item scores were summed to a total work ability score ranging from 7 (i.e poor) to 49 (i.e. excellent).

Statistical analyses

To analyze the effect of psychosocial working conditions on mental health-related LTSA and whether distress, burnout, work satisfaction, engagement and work ability mediated these associations, three types of statistical analyses were performed. First the total effects of job demands on mental health-related LTSA and the effect of job resources on mental health-related LTSA were assessed using multivariable logistic regression analyses with and without confounders. Second, to assess the mutual influences of the psychosocial working conditions, i.e., job demands and job resources, a multivariable logistic regression model was used in which the relationships between all job demands and job resources on the one hand and mental health-related LTSA on the other hand were analyzed simultaneously.

Third, multiple mediator models were used to assess the mediating role of distress and burnout in the associations between job demands and mental health-related LTSA, and to assess the mediating rom of work satisfaction, engagement, and work ability in the associations between job resources and mental health-related LTSA. The mediation analyses were performed using structural equation modeling (SEM) [34]. We estimated the effects of psychosocial working conditions on the mediators using linear regression (a paths), and the effects of the mediators on mental health-related LTSA (b paths) and the effects of psychosocial working conditions on mental LTSA (c paths) using logistic regression. Based on these pathways, the indirect effect of each psychosocial working condition on mental LTSA via a mediator was calculated as the product of the a and b path [35]. For each indirect effect a 95% percentile bootstrap confidence interval was calculated based on 1,000 bootstrap resamples [36]. The multiple mediator model based on job demands was adjusted for job resources, and the multiple mediator model based on job resources was adjusted for job demands. All analyses were performed in STATA 14 (StataCorp LP, College Station, TX, USA). Before analysis, all psychosocial working conditions were standardized and thus directly comparable.

Results

The 31,884 (59%) non-sick-listed occupational health survey participants with complete data were more often married women with higher education, working for a shorter time in their present job and with more hours per week as compared to those excluded because of missing data, although the differences were small.

Table 1 Population characteristics (N=53,833).

	Complete cases analysis (n=31,884)				**Excluded cases**[a] (n=21,949)				**Analysis**
	Mean	SD[b]	n	%	Mean	SD	n	%	
Age	45.2	10.1			44.7	10.9			P<0.01
Gender									P<0.01
men			24,499	77			17,539	80	
women			7,385	23			4,289	20	
missing			-				121		
Marital status									P<0.01
single			3,233	10			2,710	12	
relationship, but living apart			2,600	8			1,864	9	
living together/married			25,373	80			15,708	72	
other			678	2			1,043	5	
missing			-				624		
Care for children at home									P=0.21
no			13.069	41			7,234	40	
yes			18,815	59			10,714	60	
missing			-				4,001		
Education									P<0.01
low			5,284	17			4,143	19	
medium			13,660	43			9,925	46	
high			12,940	40			7,405	34	
missing			-				476		
Economic sector									P<0.01
agriculture			893	3			198	1	
industry			22,637	71			15,827	72	
commercial services			4,464	14			2984	14	
public services			3,890	12			2940	13	
missing			-				-		
Years employed at company	14.4	11.5			17.0	12.5			P<0.01
Years in present job	8.4	8.3			9.0	9.1			P<0.01
Work hours a week	38.4	7.7			37.6	7.3			P<0.01
Social support family/friends (range 1-5)	3.6	1.0			3.5	1.0			P<0.01
Prior mental LTSA[c]									P=0.23
yes			476	2			359	2	
no			31,408	98			21,603	98	
missing			-				-		
Psychosocial work factors (range 1-5)									
work pace	2.8	0.7			2.7	0.8			P<0.01
cognitive demands	3.6	0.7			3.5	0.7			P<0.01
emotional demands	1.7	0.6			1.7	0.6			P<0.01
variety in work	3.6	0.8			3.6	0.8			P<0.01
role clarity	4.0	0.7			4.0	0.7			P=0.06
learning opportunities	3.1	1.0			3.0	1.0			P<0.01
supervisor support	3.6	1.0			3.6	1.0			P<0.01
co-worker support	3.9	0.8			3.9	0.8			P<0.01
organizational commitment	3.2	0.7			3.1	0.7			P<0.01
Work – family interference (range 1-5)	1.7	0.6			1.6	0.6			P<0.01
Intrinsic work motivation (1-7)	5.9	1.0			5.9	1.0			P<0.01
Work satisfaction (range 1-5)	3.9	0.8			3.9	0.8			P<0.01
Work ability (7-49)	42.2	4.2			42.2	4.2			P=0.20
Work engagement (range 0-6)	3.8	1.1			3.7	1.1			P<0.01
Burnout (range 0-6)	2.4	0.5			2.4	0.5			P=0.48
Distress									P<0.01
low			22740	71			15,254	73	
medium			6664,	21			4,179	20	
high			2,480	8			1,463	7	
missing			-				1,053		

[a] excluded because of baseline sickness absence or missing responses
[b] standard deviation
[c] long-term sickness absence due to mental disorders in the 12 months before baseline

The survey participants (77% men) had a mean age of 45.2 years (standard deviation [SD] =10.1) and were working an average of 38.4 hours per week (SD=7.7) for 14.4 years (SD=11.5). Of all participants, 18% had a lower education, 44% a medium education and 38% were highly educated. The sectors they worked in were agriculture (3%), industry (71%), commercial services (14%), and public services (12%).

Of the 31,884 occupational health survey participants with complete data, 466 (1.5%) had mental LTSA during 1-year follow-up.

Table 2 shows the results of the univariable and multivariable logistic regression analyses, in which the psychosocial working conditions were related to mental health-related LTSA. In the univariable analyses the job demands work pace, emotional demands, and work-family interference, and the job resources role clarity, learning opportunities, supervisor support, and co-worker support were significantly associated with mental health-related LTSA. However, after correction for gender, marital status, care for children at home, education, age, years employed at company, work hours per week, support from family and friends, prior sickness long-term sickness absence due to mental complaints, only the associations of emotional demands, work-family interference, learning opportunities, and co-worker support remained significant. The relationship between emotional demands and mental health-related LTSA was the strongest after correction for other working conditions, OR 1.304 (p < 0.001, 95 % CI 1.135 to 1.498).

Table 2 Unadjusted and adjusted relationships between psychosocial working conditions and mental LTSA.

	Without confounders			*With confounders* [a]					
Psychosocial working condition	**OR**	**95% CI** [b]	**P-value**	**OR**	**95% CI**	**P-value**	**OR**	**95% CI**	**P-value**
Job demands							*Adjusted for job resources*		
Work pace	1.141	1.005 to 1.297	0.042	1.133	0.997 to 1.288	0.055	1.088	0.958 to 1.236	0.195
Cognitive demands	0.898	0.775 to 1.039	0.148	0.957	0.828 to 1.106	0.549	1.045	0.902 to 1.210	0.559
Emotional demands	1.411	1.229 to 1.620	0.000	1.367	1.191 to 1.570	0.000	1.304	1.135 to 1.498	0.000
Work-family interference	1.204	1.036 to 1.398	0.015	1.303	1.117 to 1.520	0.001	1.120	1.027 to 1.402	0.022
Job resources							*Adjusted for job demands*		
Role clarity	0.847	0.739 to 0.971	0.017	0.894	0.775 to 1.031	0.123	0.937	0.812 to 1.083	0.380
Variety in work	0.983	0.859 to 1.126	0.809	1.110	0.962 to 1.281	0.152	1.009	0.872 to 1.169	0.900
Learning opportunities	0.852	0.750 to 0.969	0.015	0.838	0.735 to 0.956	0.008	0.846	0.742 to 0.964	0.012
Supervisor support	0.888	0.794 to 0.994	0.038	0.863	0.772 to 0.966	0.010	0.897	0.802 to 1.003	0.056
Co-worker support	0.797	0.709 to 0.896	0.000	0.833	0.739 to 0.938	0.003	0.867	0.770 to 0.976	0.000

[a] Confounders: gender, marital status, care for children at home, education, age, years employed at company, work hours a week, support from family and friends, prior sickness long term sickness absence due to mental complaints.

[b] CI = confidence interval

Mediation analyses

Job demands:

Table 3 shows the direct effects of the job demands and job resources on mental health-related LTSA and the indirect effects of job demands through distress and burnout on mental health-related LTSA, and of job resources through work satisfaction, engagement, and work ability on mental health-related LTSA. Distress was the most important mediator between job demands and mental health-related LTSA and mediated the effect of work-family interference (OR 1.213; 95% CI 1.167-1.261), emotional demands (OR 1.151; 95% CI 1.119-1.184), and work pace (OR 1.056; 95% CI 1.043-1.070) on mental health-related LTSA. Emotional demands had the highest remaining direct effect on mental health-related LTSA (OR 1.144; 95 % CI 0.994-1.317), but the effect was not significant.

Burnout was not a mediator in the association between job demands and mental health-related LTSA.

Table 3 Mediation effects of distress, burnout, work satisfaction, engagement, and work ability in the relationship between job demands and resources and mental LTSA.

	Exhaustion path [b] **Mediator distress**					**Exhaustion path with job resources as confounders** [c] **Mediator distress**				
Job demands	**OR Direct effect**	**95% CI** [a]	***p***	**OR Indirect effect**	**95% CI**	**OR Direct effect**	**95% CI** [a]	***p***	**OR Indirect effect**	**95% CI** [a]
Work pace	1.051	0.926 to 1.195	0.430	1.056	1.043 to 1.070	1.037	0.913 to 1.178	0.574	1.047	1.035 to 1.060
Cognitive demands	0.952	0.825 to 1.099	0.499	1.009	0.995 to 1.010	0.977	0.843 to 1.132	0.752	1.051	1.039 to 1.064
Emotional demands	1.144	0.994 to 1.317	0.060	1.151	1.119 to 1.184	1.127	0.979 to 1,298	0.096	1.137	1.106 to 1.168
Work-family interference	1.014	0.864 to 1.190	0.865	1.213	1.167 to 1.261	0.998	0.850 to 1.172	0.985	1.170	1.131 to 1.209
Job demands	**Mediator burnout**					**Mediator burnout**				
Work pace	1.051	0.926 to 1.195	0.430	1.016	0.994 to 1.032	1.037	0.913 to 1.178	0.574	1.009	0.993 to 1.024
Cognitive demands	0.952	0.825 to 1.099	0.499	1.009	0.999 to 1.017	0.977	0.843 to 1.132	0.752	1.010	0.993 to 1.025
Emotional demands	1.144	0.994 to 1.317	0.060	1.023	0.999 to 1.047	1.127	0.979 to 1,298	0.096	1.013	0.990 to 1.035
Work-family interference	1.014	0.864 to 1.190	0.865	1.031	0.999 to 1.062	0.998	0.850 to 1.172	0.985	1.016	0.989 to 1.042
	Motivation path [b] **Mediator work satisfaction**					**Motivation path with job demands as confounders** [d] **Mediator work satisfaction**				
Job resources	**OR Direct effect**	**95% CI** [a]	***p***	**OR Indirect effect**	**95% CI**	**OR Direct effect**	**95% CI** [a]	***p***	**OR Indirect effect**	**95% CI** [a]
Role clarity	1.018	0.879 to 1.178	0.811	0.956	0.932 to 0.984	1.033	0.892 to 1.197	0.665	0.966	0.943 to 0.993
Variety in work	1.231	1.061 to 1.427	0.006	0.954	0.929 to 0.984	1.133	0.973 to 1.320	0.108	0.957	0.929 to 0.992
Learning opportunities	0.923	0.807 to 1.726	0.244	0.959	0.936 to 0.985	0.920	0.804 to 1.052	0.224	0.966	0.942 to 0.993
Supervisor support	0.902	0.806 to 1.009	0.074	0.978	0.966 to 0.993	0.926	0.827 to 1.036	0.178	0.984	0.973 to 0.997
Co-worker support	0.870	0.772 to 0.980	0.022	0.986	0.978 to 0.995	0.894	0.793 to 1.007	0.065	0.991	0.983 to 0.998
	Mediator engagement					**Mediator engagement**				
Role clarity	1.018	0.879 to 1.178	0.811	0.985	0.953 to 1.021	1.033	0.892 to 1.197	0.665	0.982	0.950 to 1.016
Variety in work	1.231	1.061 to 1.427	0.006	0.980	0.936 to 1.029	1.133	0.973 to 1.320	0.108	0.974	0.929 to 1.023
Learning opportunities	0.923	0.807 to 1.726	0.244	0.987	0.957 to 1.019	0.920	0.804 to 1.052	0.224	0.983	0.954 to 1.015
Supervisor support	0.902	0.806 to 1.009	0.074	0.996	0.986 to 1.007	0.926	0.827 to 1.036	0.178	0.995	0.986 to 1.004
Co-worker support	0.870	0.772 to 0.980	0.022	0.996	0.988 to 1.005	0.894	0.793 to 1.007	0.065	0.995	0.987 to 1.004
	Mediator work ability					**Mediator work ability**				
Role clarity	1.018	0.879 to 1.178	0.811	0.935	0.914 to 0.956	1.033	0.892 to 1.197	0.665	0.954	0.935 to 0.974
Variety in work	1.231	1.061 to 1.427	0.006	0.966	0.954 to 0.977	1.133	0.973 to 1.320	0.108	0.963	0.947 to 0.979
Learning opportunities	0.923	0.807 to 1.726	0.244	0.971	0.961 to 0.981	0.920	0.804 to 1.052	0.224	0.977	0.967 to 0.987
Supervisor support	0.902	0.806 to 1.009	0.074	0.988	0.983 to 0.993	0.926	0.827 to 1.036	0.178	0.995	0.991 to 0.998
Co-worker support	0.870	0.772 to 0.980	0.022	0.981	0.973 to 0.987	0.894	0.793 to 1.007	0.065	0.989	0.983 to 0.994

[a] CI = confidence interval
[b] with confounders gender, marital status, care for children at home, education, age, years employed at company, work hours a week, support from family and friends, and prior sickness long term sickness absence due to mental complaints.
[c] model with job demands and confounders gender, marital status, care for children at home, education, age, years employed at company, work hours a week, support from family and friends, prior sickness long term sickness absence due to mental complaints and job resources as confounders.
[d] model with job resources and confounders gender, marital status, care for children at home, education, age, years employed at company, work hours a week, support from family and friends, prior sickness long term sickness absence due to mental complaints, and job demands as confounders.

Adding job resources to the mediation analysis of distress and burnout on mental health-related LTSA had little effect.

Job resources:

Work satisfaction was a mediator of the relationship between role clarity (OR 0.956; 95 % CI 0.932 to 0.984), variety in work (OR 0.954; 95% CI 0.929-0.984), learning opportunities (OR 0.959; 95% CI 0.936-0.985), supervisor support (OR 0.978; 95 % CI 0.966-0.993), co-worker support (OR 0.986; 95% CI 0.978-0.995) and mental LTSA. Variety in work (OR 1.231; 95 % CI 1.061-1.427) and co-worker support (OR 0.870; 95% CI 0.772-0.980) had a remaining direct effect on mental health-related LTSA.

Engagement was not a mediator between job resources and mental health-related LTSA. Finally, work ability mediated the relationship between role clarity (OR 0.935; 95% CI

0.914-0.956), variety in work (OR 0.966; 95% CI 0.954-0.977), learning opportunities (OR 0.971; 95 % CI 0.961-0.981), supervisor support (OR 0.988; 95% CI 0.983-0.993), co-worker support (OR 981 95% CI 0.973-0.987) and mental health-related LTSA. Variety in work (OR 1.231; 95 % CI1.061-1.427) and co-worker support (OR 0.870; 95% CI 0.772-0.980) had a remaining direct effect on mental health-related LTSA.

Adding job demands to the analysis of the mediational effect of work satisfaction, engagement and work ability on mental health-related LTSA had little effect on the outcome.

Discussion

The present study investigated the direct and indirect effects of psychosocial working conditions on mental health-related LTSA. The job demands emotional demands and work-family interference, and the job resources learning opportunities, supervisor support and co-worker support were associated with mental health-related LTSA. After correction for other job resources and confounders, the relationship between emotional demands and mental health-related LTSA was the strongest.

High emotional demands and high work-family interference were associated with higher mental health-related LTSA. High learning opportunities, high supervisor support and high co-worker support were associated with lower mental health-related LTSA.

The literature on associations of job demands and job resources with mental health-related LTSA is scarce and contradictory. Aronsson [37] reported that high emotional demands were associated with higher sickness absence. In a study by Slany et al. [3] that was done across European countries, i.e. with different working populations and settings, the researchers were able to find clear associations for several psychosocial work factors (such as learning opportunities and social support), but not for emotional demands and social support. In contrast to our findings, Janssen et al. [38] found no association between supervisor support and mental health-related LTSA. In addition Munir et al. [39] found no effect of co-worker support on mental health-related LTSA. Our finding that higher work-family interference was associated with higher mental health-related LTSA is in line with earlier studies [40,41].

Potentially, study design (cross-sectional vs. prospective) could influence the differences in relationships found. Another explanation could be that the surveys used different questionnaires in various studies. Furthermore, an explanation for any discrepancy could be that associations of job demands and job resources vary across working populations and workplace settings [42]].

In addition, we investigated the potential mediation of several factors in the relationship between job demands and job resources and mental health-related LTSA. The associations between psychosocial working conditions and mental health-related LTSA were mediated by distress, work satisfaction, and work ability. Distress mediated the associations between the investigated job demands and mental health-related LTSA. This confirmed the hypothesis that high job demands lead to distress, through the exhaustion process [4], which in turn leads to mental health-related LTSA. In this study we found that high emotional demands and high work-family interference lead to high mental health-related LTSA, which effects were mediated by distress. Previous research has shown that adverse psychosocial working conditions lead to distress [8-13] and burnout [16.17]. In turn, sustained distress [14,15] and burnout [18] lead to mental health-related LTSA. The finding that distress mediated the relations between psychosocial working conditions and mental health-related LTSA was therefore expected, but to our knowledge not examined in research before. The mediational effect of burnout on the associations between job demands and mental health-related LTSA was also expected, yet not confirmed in our study.

Job resources are described to buffer the effect of job demands on mental LTSA [6]. However, adding job resources to our analysis of the mediational effect of distress and burnout on mental health-related LTSA had little effect on the outcome.

In this study we found that work satisfaction and work ability mediated the effect of

role clarity, learning opportunities and variety in work on mental health-related LTSA. We found that the effects of all analyzed job resources (role clarity, variety in work, learning opportunities, supervisor support, and co-worker support) on mental health-related LTSA were mediated by work satisfaction as well as work ability. This indicates that work satisfaction and work ability play an important role in the motivational process through which psychosocial working conditions operate. The role of work satisfaction and engagement in the motivational process has been described earlier [4,21]. Previous research found an association between engagement and work ability [22,43]. The current study confirmed the suspected role of work ability in the motivational process. Although the mediational role of work satisfaction and work ability in the association between psychosocial working conditions and mental health-related LTSA could be expected, it was to our knowledge not investigated before in a mediation analysis. The mediational effect of engagement on the relation between job resources and mental health-related mental LTSA was also expected, yet not confirmed in our study. Although not described in literature, we wanted to investigate if job demands do buffer the effect of job resource on mental LTSA. Adding job demands to our analysis of the mediational effect of work satisfaction, engagement and work ability had little effect on the outcome.

Strengths and limitations:

The large study population, prospective study design, and the use of recorded OP-certified mental health-related LTSA were strengths of the study. It is one of the few studies looking into explanatory mechanisms of the relationship between psychosocial work characteristics and mental health-related LTSA. Another strength of this study was that multiple mediators were investigated. Although large, the study population was not representative of the Dutch workforce, since industry and commercial business sectors were overrepresented and agriculture and public services were underrepresented. Therefore the results of our study cannot be applied to all sectors and we advise to repeat this study in other economic sectors. Forty-three percent of the participants were excluded because of missing data. However, we assumed the data to be missing completely at random following the comparison we made based on three characteristics, which justified the use of complete case analysis.

Furthermore, the psychosocial working conditions in the current study were measured with a questionnaire and therefore reflected the worker's subjective perception of the psychosocial working conditions rather than an objective one. Rehkopf et al. [44] reported that external measures of psychosocial working conditions were more strongly associated with higher sickness absence compared with self-assessed measures. It would be interesting to repeat our study with externally measured psychosocial working conditions.

The association between the psychosocial working conditions and mediation factors may have been a result of reversed causality, because they were measured at the same time. We theorized that job demands and resources had effects on the mediators. In reality, these effects are more complex and can be reciprocal, which provides directions for future research. For example, future research could be conducted in which the reciprocal effects of psychosocial working conditions, distress, burnout, work satisfaction, engagement, work ability, and mental health LTSA are investigated based on longitudinal data using cross-lagged panel models [35,45,46].

Practical implications

The guideline of the Netherlands Society of Occupational Medicine [47] states that occupational health physicians should explore the causes of mental complaints during consultations. According to our findings, low learning opportunities, low co-worker and supervisor support, high emotional demands, and high work-family interference are associated with mental health-related LTSA. We therefore advise that during occupational health consultations, particular interest is paid to these psychosocial working conditions. In addition, distress, job satisfaction, and work ability are advised to be investigated, since they seem to play a mediational role in the exhaustion and motivation processes. In order to prevent mental health-related LTSA, companies are therefore advised to take action to enhance learning opportunities, supervisor support, and co-worker support. These psychosocial working conditions together with emotional demands, work-family interference, distress, work satisfaction, and work ability are advised to be measured periodically in occupational health surveys. Employers could also train supervisors to recognize early signs of distress, dissatisfaction, and low work ability in their employees. Previous studies showed that preventive consultations with workers at risk of mental illness reduced the frequency and duration of mental health-related LTSA [48,49)]. Workers at risk of mental health-related LTSA can be invited for a consultation with an occupational physician or nurse and, if necessary, be referred to a psychologist to prevent them from experiencing mental health-related LTSA [50].

Since the effect of emotional demands on mental LTSA was found to be the strongest, it is important to teach workers by means of a preventive training to regulate their emotions on a daily basis [51]. There is increasing evidence that work breaks improve mental health of employees especially in prolonged high job demands [52-54]. Employers are advised to give workers time to recover during work in jobs with high emotional demands.

To our knowledge the mediational role of work ability has not been described before. We advise to repeat this study in other populations, especially in populations with more women such as healthcare and education.

Conclusions

Psychosocial working conditions are related to mental health-related LTSA. After correction for other working conditions, the association between emotional demands and mental health-related LTSA was the strongest. Psychosocial working conditions are indirectly related to mental health-related LTSA by mediation of distress, work satisfaction, and work ability.

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Chapter 8

Development of prediction models for sickness absence due to mental disorders in the general working population

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Abstract

Objective
This study investigated if and how occupational health survey variables can be used to identify workers at risk of long-term sickness absence (LTSA) due to mental disorders.

Methods
Cohort study including 53,833 non-sicklisted participants in occupational health surveys between 2010 and 2013. Twenty-seven survey variables were included in a backward stepwise logistic regression analysis with mental LTSA at 1-year follow-up as outcome variable. The same variables were also used for decision tree analysis. Discrimination between participants with and without mental LTSA during follow-up was investigated by using the area under the receiver operating characteristic curve (AUC); the AUC was internally validated in 100 bootstrap samples.

Results
30,857 (57%) participants had complete data for analysis; 450 (1.5%) participants had mental LTSA during follow-up. Discrimination by an 11-predictor logistic regression model (gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/ friends, work satisfaction, and distress) was AUC=0.713 (95% CI 0.692 – 0.732). A 3-node decision tree (distress, gender, work satisfaction, and work pace) also discriminated between participants with and without mental LTSA at follow-up (AUC=0.709; 95% CI 0.615 – 0.804).

Conclusions
An 11-predictor regression model and a 3-node decision tree equally well identified workers at risk of mental LTSA. The decision tree provides better insight into the mental LTSA risk groups and is easier to use in occupational health care practice.

Introduction

Mental disorders account for a large and growing burden of disease worldwide, particularly among individuals of working age: it affects one fifth of the working population at any given moment [(1)]. Workers with mental disorders have poorer work outcomes than those in good mental health [(2)]. They are at risk of long-term sickness absence (LTSA i.e., sickness absence episodes of 6 weeks or longer), which disconnects them from the workplace, leading to work disability, unemployment and poverty [(3)]. Mental disorders also have economic consequences. Employers struggle with productivity losses and high absence rates. At the societal level, the costs of social and health care expenditures on mental disorders amount up to 4% of the gross national product [(1)]. Given the significant burden for individuals, companies, and societies, the Organization of Economic Cooperation and Development (OECD) pleaded that mental disorders need to become a priority for stakeholders in the workplace.

If stakeholders in the workplace recognize mental disorders among non-sicklisted workers, they could accommodate work duties or times to prevent LTSA due to mental disorders. Previous studies have shown that mental health symptoms measured with the 4-Dimensional Symptom Questionnaire (4DSQ) can identify non-sick-listed workers who are at increased risk of mental LTSA (4-6). Roelen et al [(4)]. showed that the 4DSQ distress subscale discriminated office workers with mental LTSA from those without mental LTSA during 1-year follow up, with an area under the receiver operating characteristic curve (AUC) of 0.71; the 4DSQ subscales for depression (AUC=0.66), anxiety (AUC=0.64) and somatization (AUC=0.68) showed poorer discrimination. In a later study, the 4DSQ distress scale was also found to discriminate between postal workers with and without mental LTSA (AUC=0.75), whereas depressive symptoms (AUC=0.64) and fatigue (AUC=0.61) did not discriminate between postal workers with and without mental LTSA during 2-year follow-up [(5)]. The 4DSQ distress scale could be a promising tool identify workers at risk of mental LTSA, although additional predictor variables are needed to improve discrimination between workers with and without mental LTSA [(6)].

In a Swedish population study, the risk of mental LTSA was higher in women, workers aged 30-39 years and in families with underage children [(7)]. Furthermore, workers in health care, education and social services had an elevated mental LTSA risk. The Oslo Health Study revealed that women had a higher risk of mental LTSA than men [(8)]. Distress, low education, and low supervisor support increased the risk of mental LTSA, although the effect of supervisor support was mediated through distress. Supervisor support and other psychosocial work factors have been associated with the risk of mental disorders. In a systematic review of the literature, Nieuwenhuijsen et al. [(9)] reported that high job demands, low decision latitude, low co-worker support, and a high effort-reward imbalance predicted the incidence of stress-related mental disorders.

Psychosocial work factors are commonly addressed in occupational health surveys. Several studies have investigated the use of health survey variables to identify workers at risk of LTSA irrespective of cause. Airaksinen et al. [(10)] reported that a prediction model including age, gender, socioeconomic position, self-rated health, depression, previous sickness absence, number of chronic diseases, body mass index, smoking, shift work, working night shifts, and sleep disturbance discriminated between Finnish workers with and without LTSA ≥90

consecutive days (AUC=0.73). Roelen et al. [11]. showed that a prediction model including age, gender, education, self-rated health, mental health, prior LTSA, work ability, emotional demands and recognition by the management moderately discriminated between Danish workers with and without LTSA ≥28 consecutive days during 1-year follow-up (AUC=0.68), possibly due to the fact that the authors were not able to differentiate between LTSA causes.

Another explanation for the moderate discrimination by the prediction model might be that important interactions between predictor variables were not taken into account. The assessment of interactions in regression models requires pre-specification of interaction terms. In regression models with many variables, the number of possible interactions that can be investigated is large and may lead to a complicated model that can be difficult to use in healthcare practice [12]. Decision tree analysis (DTA) is a non-parametric statistical method that takes interactions and non-linear relationships among predictor variables into account [13].

The aim of the present study was to develop a multivariable prediction model specifically for mental LTSA by using logistic regression analysis and DTA. The logistic regression model and decision tree were compared in their ability to identify occupational health survey participants with mental LTSA during 1-year follow up.

Methods

Study population and design

According to the Dutch Labor Law, companies have to enable their employees to participate in an occupational health survey once every four years. Occupational health surveys are conducted by occupational health services (OHS) and consist of an online occupational health survey questionnaire. The questionnaire results are collected and analyzed by the OHS; participants receive an individual feedback and companies receive a survey report presenting the survey results at team/department level. At the request of trade organizations, companies or staff representatives, occupational health survey participants can consult with OHS professionals to discuss their individual questionnaire results, explore work and health risk factors and get an advice on how to reduce risk factors.

The present study used the occupational health survey questionnaire results of 53,833 workers who participated in surveys between 2010 and 2013. A cohort design was used, with the occupational health survey as baseline and sickness absence recorded in the year following the occupational health survey as follow-up. The 2207 survey participants who were on sickness absence at baseline were excluded from the study. Results are presented in line with the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD) [14].

Outcome: mental long-term sickness absence (LTSA)

Sickness absence was defined as a temporary paid leave from work due to any (i.e., work-related as well as non-work-related) injury or illness, and was recorded from the first to the last sickness absence day in an occupational health service (OHS) register. In The Netherlands, sickness absence is medically certified by an occupational physician (OP) within 6 weeks of reporting sick. Therefore, LTSA was defined as sickness absence lasting 6 weeks or longer.

Based on a consultation with a sick-listed worker, the OP records a diagnostic code derived from the 10th International Classification of Diseases (ICD-10) in the OHS register. Mental LTSA was defined as LTSA with diagnostic codes of the ICD-10 chapter V (Mental and Behavioral Disorders). Mental LTSA during 1-year follow-up was used as the outcome variable.

Predictors: occupational health survey variables

Sociodemographic variables

Age, gender, marital status (single, living together/married, other), care for children at home (yes, no) and education (low = primary school and lower vocational education; medium = secondary general or vocational education; high = higher vocational and academic education) were retrieved from the occupational health survey questionnaire.

Work-related characteristics

The occupational health survey questionnaire asked for the economic sector (agriculture, manufacturing, commercial services, or public services), number of years employed at the company, the number of years in the present job and the average number of hours worked per week.

Work pace (5 items, Cronbach's α=0.87), cognitive demands (5 items, α=0.82), emotional demands (3 items, α=0.80), variety in work (6 items; α=0.86), role clarity (5 items; α=0.85),

learning opportunities (4 items; α=0.87), supervisor support (3 items; α=0.90), co-worker support (3 items; α=0.88) and organizational commitment (5 items; α=0.79) were measured with the Questionnaire on the Experience and Evaluation of Work [15]. Survey participants responded on a five-point frequency scale ranging from 'never' (=1) to 'always' (=5) and item scores were summed to a total subscale score, which was then divided by the number of items in the scale. Consequently, all psychosocial work characteristics had a score range between 1 (=low) and 5 (= high).

Social support from family and friends was assessed with 3 QEEW items (Can you count on the support of partner/family/friends when you have some difficulty at work? Is work at home taken out of your hands if you are busier at work? Do you feel appreciated by your partner/family/friends?; α=0.77). Survey participants responded on a five-point frequency scale ranging from 'never' (=1) to 'always' (=5) and item scores were summed and averaged so that social support from family/friends ranged between 1 (=low) and 5 (= high).

Work – family interference was assessed with 7 QEEW items (e.g., How often does your job interfere with responsibilities at home? How often does your job prevent you from spending time with family and friends?; α=0.88). Responses were given on 5-point frequency scales ranging from 'never' (=1) to 'always' (=5); item scores were summed and averaged so that work family interference ranged between 1 (=low) and 5 (=high).

Work satisfaction was measured with 6 QEEW items (α=0.87) about pleasure in work (e.g., I am pleased to start my day's work; I find my work stimulating; I enjoy my work). Responses were given on 5-point frequency scales ranging from 'never' (=1) to 'always' (=5). Items scores were summed and averaged, so that work satisfaction ranged between 1 (=low) and 5 (=high).

Intrinsic work motivation was measured with the 7-item interest/enjoyment subscale of the Intrinsic Motivation Inventory [16]. This subscale asks survey participants to rate statements, such as 'I enjoy my work' and 'I like to do my job' on a Likert scale ranging from 'not true at all' (=1) to 'totally true' (=7). The items were summed to an intrinsic work motivation score (α=0.89), which was then averaged to a score range between 1 (=low) to 7 (=high).

Work ability was measured with a shortened version of the Work Ability Index covering items on current work ability compared with lifetime best, work ability in relation to the (physical and mental) demands of work, number of physician-diagnosed diseases, impaired work performance due to illness, sickness absence in the past 12 months, expected work ability in the forthcoming two years, and mental resources [17]. The item scores were summed to a total work ability score ranging from 7 (=poor) to 49 (=excellent).

Work engagement was measured with a 9-item short form of the Utrecht Work Engagement Scale [18]. The items were scored on a 6-point frequency scale ranging from 'never' (=0), 'scarcely' (=1), 'sometimes' (=2), 'regularly' (=3), 'often' (=4), 'very often' (=5), and 'always' (=6). The items scores were summed and averaged to a work engagement score between 0 (=low) and 6 (=high). Burnout was measured with the 15-item Dutch version of the Maslach Burnout Inventory – General Scale [19]. Items were scored on a 6-point frequency scale, summed and averaged into a burnout score between 0 (=low) to 6 (=high).

Distress was measured with the Four-Dimensional Symptom Questionnaire (4DSQ), which was included in the occupational health survey questionnaire. The distress scale consisted of 16 items addressing symptoms elicited by stressors or the efforts to maintain

psychosocial functioning, such as worry, irritability, tension, listlessness, poor concentration, sleeping problems and demoralization [20,21]. Survey participants were asked if they experienced these symptoms in the past week, 'no' (=0), 'sometimes' (=1), 'regularly' (=2), 'often' (=2), or 'very often/constantly' (=2). Item scores were summed (score range 0–32; Cronbach's α=0.94) so that higher scores reflected higher levels of distress. Terluin et al. (22) defined scores ≤10 as low, 11-20 as moderate, and >20 as high distress.

LTSA episodes in the year prior to the occupational health survey were retrieved from the OHS register regardless of cause, and used for the predictor variable 'prior LTSA' (yes=1, no=0).

Missing data

Of the 51,626 non-sicklisted occupational health survey participants, 20,769 had missing responses on one or more predictor variables. Missing data analysis showed that missingness was not related to the risk of mental LTSA. Therefore, it is reasonable to assume that complete cases analysis will be unbiased. If all 27 occupational health survey variables were included in a model, 270 mental LTSA events would be needed to fulfill the rule of 10 outcome events per variable [23]. The 30,857 participants with complete data had 450 mental LTSA events, which was more than sufficient for estimating stable regression coefficients.

Statistical analysis

The logistic regression model and decision tree were developed using IBM SPSS Statistics for Windows, version 24 (released 2016; IBM Corp. Armonk, NY).

Logistic regression analysis

Twenty-seven occupational health survey variables were included in a multivariable logistic regression model as candidate predictor variables. Gender, marital status, care for children at home, education, prior mental LTSA, economic sector, and distress were included as categorical variables. Age, the number of years employed at the company and in the present job, average number of hours worked per week, work pace, cognitive demands, emotional demands, variety in work, role clarity, learning opportunities, supervisor support, co-worker support, organizational commitment, social support from family/friends, work – family interference, intrinsic work motivation, work satisfaction, work ability, work engagement and burnout were included as continuous variables in a multivariable logistic regression model with mental LTSA at follow-up (no=0, yes=1) as outcome variable. The full 27-predictor model was reduced by a backward stepwise procedure, using Akaike's Information Criterion as stopping rule.

Decision tree analysis (DTA)

The same 27 predictor variables were entered in DTA, using the Chi-square Automatic Interaction Detector (CHAID) algorithm to partition the data. CHAID is a multi-way tree algorithm that analyses each potential predictor and all possible cut-off points to split the data [23]. Partitioning starts with the predictor variable which splits the population into subsets that differ most in their risk of mental LTSA. After the first split, subsets are partitioned over and over again by other predictor variables until no further significant partitioning is possible. Large decision trees tend to be unstable and are prone to overfitting

[12,13,23]. Therefore, partitioning was stopped if groups included less than 1000 participants and/or less than 50 mental LTSA events.

Logistic regression versus decision tree

Discrimination between survey participants with and without mental LTSA was investigated by using receiver operating characteristic (ROC) analysis. The area under the ROC-curve (AUC) represented discrimination between survey participants with and without mental LTSA in the year following the occupational health survey. AUC is the probability that a randomly chosen survey participant with mental LTSA has a higher risk score than a randomly chosen participant without mental LTSA. In the present study, AUC<0.60 represents failing, 0.60–0.69 poor, 0.70–0.79 fair, 0.80–0.89 good, and 0.90–1.00 perfect discrimination.

The AUCs were validated in 100 bootstrap samples by using the regression modeling strategies (rms) package in R (statistical computing) for Windows, version 3.5.1 [24]. The internally validated AUC better than the non-validated AUC reflects discrimination that can be expected in new samples of occupational health survey participants.

Results

The 30,857 (57%) non-sicklisted occupational health survey participants with complete data and were more often female, married, higher educated, working for a shorter time at the company and in their present job as compared to those excluded because of missing data, although the differences were small (Table 1).

Table 1 Population characteristics (N=53,833).

	Complete cases for analysis (n=30,857)				**Excluded because of missing data** (n=22,976)			
	Mean	SD[a]	n	%	Mean	SD	n	%
Sociodemographic variables								
Age	45.2	10.1			44.7	10.9		
Gender								
men			23,710	77			18,363	80
women			7,147	23			4,492	20
missing			-				121	
Marital status								
single			3,129	10			2,837	12
relationship, but living apart			2,516	8			1,951	9
living together/married			24,556	80			16,443	72
other			656	2			1,09	5
missing			-				654	
Care for children at home								
no			12,648	41			7,573	40
yes			18,209	59			11,215	60
missing			-				4,188	
Education								
low			5,114	17			4,337	19
medium			13,219	43			10,390	46
high			12,522	40			7,751	34
missing			-				498	
Years employed at company	14.4	11.5			17.0	12.5		
Years in present job	8.4	8.3			9.0	9.1		
Work hours per week	38.4	7.7			37.6	7.3		
Prior mental LTSA[b]								
yes			461	2			362	2

no			30,396	98			22,614	98
missing			-				-	
Psychosocial work factors (range 1-5)								
work pace	2.8	0.7			2.7	0.8		
cognitive demands	3.6	0.7			3.5	0.7		
emotional demands	1.7	0.6			1.7	0.6		
variety in work	3.6	0.8			3.6	0.8		
role clarity	4.0	0.7			4.0	0.7		
learning opportunities	3.1	1.0			3.0	1.0		
support supervisor	3.6	1.0			3.6	1.0		
support co-workers	3.9	0.8			3.9	0.8		
organizational commitment	3.2	0.7			3.1	0.7		
Social support family/friends (range 1-5)	3.6	1.0			3.5	1.0		
Work – family interference (range 1-5)	1.7	0.6			1.6	0.6		
Intrinsic work motivation (1-7)	5.9	1.0			5.9	1.0		
Work satisfaction (range 1-5)	3.9	0.8			3.9	0.8		
Work ability (7-49)	42.2	4.2			42.2	4.2		
Work engagement (range 0-6)	3.8	1.1			3.7	1.1		
Burnout (range 0-6)	2.4	0.5			2.4	0.5		
Distress								
low			22,008	71			16,065	73
medium			6,449	21			4,455	20
high			2,400	8			1,600	7
missing			-				1,053	

[a] standard deviation
[b] long-term sickness absence due to mental disorders in the 12 months before baseline

Logistic regression analysis

Of the 30,857 occupational health survey participants with complete data, 450 (1.5%) had mental LTSA during 1-year follow-up. When all 27 occupational health survey variables were included in the logistic regression model, distress and gender were the strongest predictors of mental LTSA (Table 2). After backward stepwise logistic regression analysis, gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress remained in the final logistic regression model for mental LTSA.

Table 2 Logistic regression analysis (n=30,857).

	Full model			**Final model**	
	Wald[a]	**OR[b]**	**95% CI[b]**		
Age	0.305	1.004	0.989–1.020		
Gender					
Men		1		1	
Women	20.858	2.044	1.504–2.777	1.927	1.475–2.517
Marital Status					
Single	6.989	1	6.989	1	
Relationship, but living apart	.823	1.239	0.780–1.966	1.239	0.783–1.959
Living together/married	1.550	0.785	0.536–1.150	0.795	0.554–1.140
Other	1.063	0.578	0.204–1.639	0.559	0.198–1.578
Care for children at home					
No		1			
Yes	0.010	0.987	0.762–1.278		
Education					
Low	2.043	1			
Medium	0.618	0.869	0.612–1.233		
High	1.957	0.759	0.517–1.117		
Economic sector					
Agriculture	5.676	1	5.676	1	
Manufacturing	1.559	0.727	0.441–1.199	0.738	0.449–1.215
Commercial services	1.448	0.704	0.397–1.247	0.719	0.407–1.269
Public services	0.010	1.028	0.595–1.779	1.044	0.611–1.783
Years employed at company	3.621	0.986	0.971–1.000	0.991	0.979–1.003
Years in present job	0.053	0.998	0.980–1.016		
Work hours per week	0.063	1.002	0.984–1.021		
Prior Mental LTSA [c]					
No		1			
Yes	1.210	1.396	0.771–2.527		
Work Pace	0.044	1.017	0.866–1.195		
Cognitive demands	4.078	1.218	1.006–1.474	1.248	1.064–1.463
Emotional demands	0.000	0.999	0.833–1.198		
Variety in work	2.131	1.161	0.950–1.420		
Role clarity	2.323	1.157	0.959–1.397	1.140	0.957–1.358
Learning opportunities	1.261	0.904	0.758–1.078		
Support supervisor	0.262	0.963	0.834–1.112		
Support co-workers	1.613	0.907	0.779–1.055	0.880	0.763–1.015
Organizational commitment	2.543	1.171	0.964–1.423		
Social support family/friends	1.802	0.915	0.804–1.042	0.912	0.804–1.035
Work-family interference	0.069	0.973	0.792–1.195		
Intrinsic work motivation	0.366	0.942	0.774–1.145		
Work satisfaction	4.101	0.811	0.663–0.993	0.776	0.666–0.905

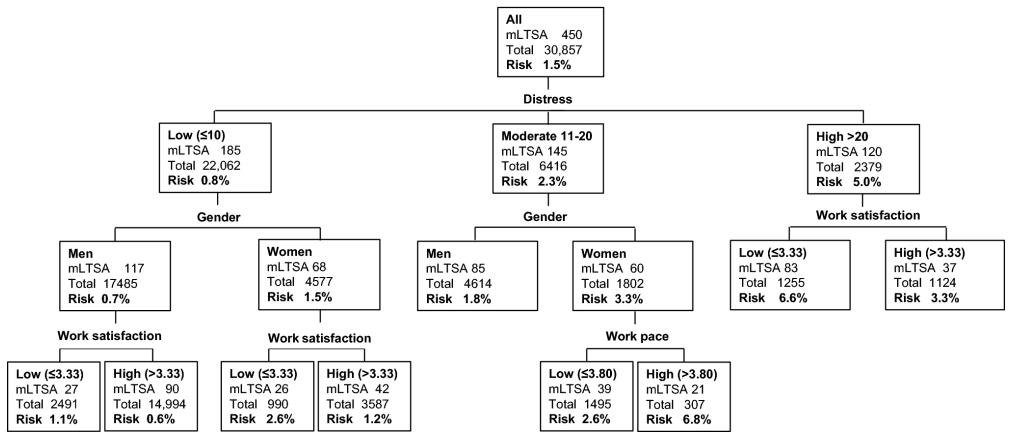
Work satisfaction	4.101	0.811	0.663–0.993	0.776	0.666–0.905
Work ability	3.282	0.973	0.944–1.002	0.962	0.936–0.988
Work engagement	0.492	0.979	0.923–1.039		
Burnout	0.521	1.033	0.946–1.127		
Distress					
Low	28.710	1		1	
Medium	18.273	1.921	1.424–2.592	2.021	1.514–2.698
High	25.271	2.802	1.875–4.186	3.124	2.157–4.526

[a]Wald statistic is calculated as $(B/SE)^2$ where B is the regression coefficient and SE its standard error; higher Wald-statistics represent stronger predictors of mental LTSA
[b]Odds ratio and 95% confidence interval
[c]Long-term sickness absence due to mental disorders in the 12 months before baseline

Decision-tree analysis (DTA)

DTA revealed distress as the first node of the decision tree, indicating that it was the strongest predictor of mental LTSA. Survey participants with low distress scores had a 0.8% risk of mental LTSA and survey participants with moderate distress scores had a 2.3% risk of mental LTSA (Figure 1). Survey participants with high distress scores had a 5.0% risk of mental LTSA, which is more than 3 times higher than the 1.5% population risk.

Figure 1 Decision tree.



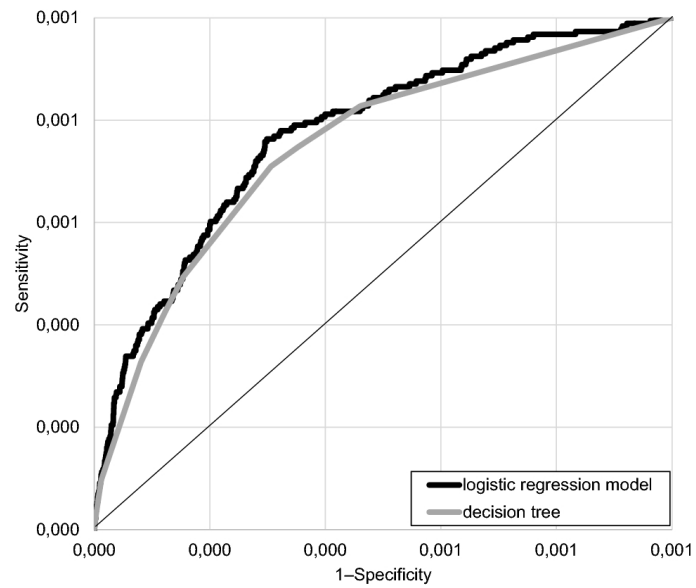
Of the survey participants with low distress scores, only women reporting low work satisfaction had an increased risk of mental LTSA as compared to the population risk. Amongst survey participants with moderate distress scores, women were at increased 3.3% risk of mental LTSA, particularly those experiencing a high work pace who had a 6.7% risk of mental LTSA. Survey participants with high distress scores and low work satisfaction had a 6.6% risk of mental LTSA during follow-up.

Logistic regression versus decision tree

ROC analysis showed that the final 11-predictor logistic regression model fairly discriminated (AUC=0.740; 95% CI 0.711–0.768) between survey participants with and without mental LTSA during follow-up; the bootstrap validated AUC was 0.713 (95% CI 0.692 – 0.732).

In comparison, discrimination by the decision tree was AUC=0.727 (95% CI 0.701 – 0.753) and the bootstrap validated AUC was 0.709 (95% CI 0.615 – 0.804). Figure 2 shows that the discriminative ability of the decision tree was as good as that of the logistic regression model.

Figure 2 Discrimination graph.



Discussion

The present study used occupational health survey variables to predict mental LTSA during 1-year follow-up of survey participants. An 11-predictor logistic regression model including gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress discriminated between survey participants with and without mental LTSA during follow-up. Discrimination by the logistic regression model was of the same magnitude as discrimination found in previous studies [4-6]. Although decision tree analysis takes interactions between predictor variables into account, a decision tree based on distress, gender, work satisfaction and work pace did not result in better mental LTSA predictions. This may indicate that interactions between the 27 occupational health survey variables did not contribute to mental LTSA predictions.

In line with previous studies [4-6], we found that distress was the strongest predictor of mental LTSA. Furthermore, the present results confirmed that female gender and prior LTSA were associated with a significantly higher LTSA risk [10,11]]. Socioeconomic position [10] and education [11] are important LTSA predictors, but in our study education did not remain in the final prediction model for mental LTSA. When we re-analyzed the results with all-cause LTSA as outcome, education did remain in the prediction model [data not shown]. This may indicate that education is an important LTSA predictor, but not specifically of mental LTSA.

The present study also confirmed that the economic sector was an important predictor of mental LTSA. The mental LTSA risk was lower in manufacturing and commercial services as compared to agriculture, which was the reference group. In line with the findings, of Lidwall et al. [7], the risk of mental LTSA in public services was higher than in the other economic sectors.

Cognitive job demands were significantly associated with the risk of mental LTSA and remained in the final regression model, which agrees with the results of a review on the psychosocial work environment and stress-related disorders [7]. Co-worker support, but not supervisor support remained in the final regression model. It has been reported that the effect of low supervisor support on mental LTSA is mediated by distress [8], which may explain why supervisor support was removed from a model that also contained distress. The present study showed that low support from family and friends adds to mental LTSA risk predictions.

Strengths and weaknesses of the study

The large study sample, prospective study design, the use of recorded OP-certified LTSA and the different statistical methods to analyze large amounts of data are strengths of the study. However, some potential limitations of the study should be discussed. Although large, the study population was not representative of the Dutch workforce as manufacturing and commercial business was over-represented and agriculture and public services were under-represented. Forty-three percent of the participants were excluded because of missing data. We found that missings were not related to mental LTSA and therefore complete cases analysis was acceptable.

Decision trees more than regression models are data-driven and small perturbation in the data could lead to substantial changes in the decision tree [12,24]. We dealt with this problem by defining cut-offs, stopping recursive partitioning if groups contained less than 1000 participants and/or less than 50 mental LTSA events. This 'pruning' improves the stability and practical use, but reduces the predictive accuracy of decision trees.

The performance of prediction models is overestimated when results are based on the sample of subjects used to develop the models. Bootstrapping has been recommended to estimate the internal validity of a predictive logistic regression model [25]. Discrimination by the regression model and decision tree was validated in 100 bootstrap samples. The bootstrap validated AUCs reflects discrimination between participants with and without mental LTSA in new occupational health survey samples and herewith increased the external validity of our results.

Implications for practice and further research

Based on their disappointing performance, Burdorf [26] pleads for using prediction models to detect predictors of LTSA rather than deliver predictions for individuals at risk. He advocates a population approach to discover and control the causes of LTSA in the workforce. Companies receive an occupational health survey report on the group or department level, which could be used to take actions to prevent mental LTSA in the company's workforce. However, preventive actions aimed at the individual might as well contribute to the prevention of mental LTSA. It is superfluous to advise all occupational health survey participants, as only 1.5% of them develops mental LTSA in the year following the survey. The 11-predictor logistic regression model could be used to identify workers at risk of mental LTSA and provide them with a preventive advice or invite them to a preventive consultation. For that purpose, the occupational health provider has to define a cut-off risk score: participants with a predicted risk above the cut-off score are invited whereas those with a risk below the cut-off score are not invited. However, the problem is that the 11-predictor prediction model does not have an optimal cut-off score. Low risk cut-offs result in the unnecessary invitation of many participants who will not develop mental LTSA. Alternatively, many of the participants who develop mental LTSA are missed if high risk cut-offs were used.

Based on the decision tree, the occupational health provider can more easily decide which occupational health survey participants should be given preventive advices or be invited to preventive consultations, because there is no need to set cut-off scores. The decision tree readily shows the mental LTSA risk groups. For example, an occupational health provider could decide to invite survey participants with moderate and high distress scores to preventive consultations. The decision tree shows that this would implicate that 8795 (29%) of 30,857 occupational health survey participants would be invited, including 265 (59%) of those who have mental LTSA (n=450) in the year following the survey. If resources are limited, the occupational health provider could decide to only invite female survey participants experiencing moderate distress and high work pace (n=307) as well as both male and female participants with high distress scores and low work satisfaction (n=1255). This would involve 5% of all survey participants and 23% of those with mental LTSA in the year following the survey. Thus, the decision tree is a practical tool to identify high-risk groups for preventive consultations. Given the fact that decision trees are data driven and the relatively broad 95% confidence interval of the validated discrimination, the decision tree has to be externally validated in other samples of occupational health survey participants, before we can recommend its use in occupational healthcare practice.

Conclusions

A 3-node decision tree (distress, gender, work satisfaction and work pace) and an 11-predictor regression model (gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress) equally well identified occupational health survey participants at increased risk of mental LTSA during 1-year follow-up. If externally validated, the decision tree is more practical than the regression model to identify mental LTSA risk groups in occupational health surveys.

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Chapter 9

External validation of a prediction model and decision tree for sickness absence due to mental disorders

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Abstract

Objective
A previously developed prediction model and decision tree were externally validated for their ability to identify occupational health survey participants at increased risk of long-term sickness absence (LTSA) due to mental disorders.

Methods
The study population consisted of N= 3415 employees in mobility services who were invited in 2016 for an occupational health survey, consisting of an online questionnaire measuring the health status and working conditions, followed by a preventive consultation with an occupational health provider (OHP). The survey variables of the previously developed prediction model and decision tree were used for predicting mental LTSA (no= 0, yes = 1) at 1-year follow-up. Discrimination between survey participants with and without mental LTSA was investigated with the area under the receiver operating characteristic curve (AUC).

Results
A total of n=1736 (51%) non-sick-listed employees participated in the survey and 51 (3%) of them had mental LTSA during follow-up. The prediction model discriminated (AUC = 0.700; 95% CI 0.628–0.773) between participants with and without mental LTSA during follow-up. Discrimination by the decision tree (AUC = 0.671; 95% CI 0.589–0.753) did not differ significantly (p = 0.62) from discrimination by the prediction model.

Conclusions
At external validation, the prediction model and the decision tree both poorly identified occupational healthsurvey participants at increased risk of mental LTSA. OHPs could use the decision tree to determine if mental LTSA risk factors should be explored in the preventive consultation which follows after completing the survey questionnaire.

Introduction

Mental disorders are the major cause of long-term sickness absence (LTSA) in member countries of the Organization of Economic Co-operation and Development [(1)]. Mental LTSA disconnects workers from the workplace and marginalizes them from the labor market, leading to unemployment, social isolation, and poorer mental health [(2)]. Therefore, it is important to identify workers at risk of mental LTSA before they report sick.

Previous studies have shown that distress symptoms identify non-sicklisted workers with an increased risk of future mental LTSA [(3-5)]. Recently, Van Hoffen et al. [(6)] included distress in a multivariable prediction model for mental LTSA with gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, and work satisfaction as additional predictor variables. The authors reported that this 11-predictor model correctly assigned the highest risk to those who had mental LTSA during 1-year follow-up in 71.3% of the cases. Furthermore, they found that a 3-knot decision tree based on distress, gender, work satisfaction and work pace correctly identified workers with mental LTSA in 70.9% of the cases. Decision trees are easier to interpret than regression formulas and are therefore more user-friendly for healthcare practice [(74)]. However, decision trees more than regression models depend on the data in which they are developed, and may therefore be less valid in new populations of workers [(8)].

The aim of the present study was to validate the previously developed prediction model and decision tree in a new sample of occupational health survey participants. If externally valid, the prediction model and/or decision tree can be implemented in occupational healthcare practice to identify workers at risk of mental LTSA and invite high-risk workers for consultations to give them a preventive advice or refer them to interventions aimed at preventing mental LTSA.

Methods

Study population and design

For this study, we used the data of 3,415 workers in mobility services, who were invited to participate in an occupational health survey in 2016. The occupational health survey was conducted by an occupational health service (OHS) and consisted of an online occupational health survey questionnaire addressing health status and working conditions. The questionnaire results were collected and analyzed by the OHS. The participants received online individual feedback and were invited to preventive consultations if appropriate. The organisation received a report from the OHS with advices at the department level.

The present study was set up as a prospective cohort study with the occupational health survey as baseline. Sickness absence was recorded by the OHS during 1-year follow-up. Results are presented in line with the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis [(9)].

Outcome: long-term sickness absence (LTSA)

Sickness absence was defined as a temporary paid leave from work due to any (i.e., work-related as well as non-work-related) injury or illness, and was recorded from the first to the last sickness absence day in the OHS register. In The Netherlands, sickness absence is medically certified by an occupational physician (OP) within 42 days of reporting sick. Therefore, LTSA was defined as sickness absence lasting 42 days or longer.

Based on a consultation with a sick-listed worker, the OP records a diagnostic code derived from the 10th International Classification of Diseases (ICD-10) in the OHS register. Mental LTSA was defined as LTSA with diagnostic codes of the ICD-10 chapter V (Mental and Behavioral Disorders). Mental LTSA in the 12 months prior to the occupational health survey was used for the predictor variable 'prior mental LTSA'. Mental LTSA during 1-year follow-up was used as the outcome variable.

Predictors

The predictor variables were measured with the same items and scales as in the development study [(6)]. Gender, and the number of years employed at the company were retrieved from the occupational health survey questionnaire.

Work pace (5 items, Cronbach's α=0.85), role clarity (5 items, α=0.84), cognitive demands (5 items, α=0.82), learning opportunities (4 items, α=0.86), and co-worker support (3 items, α=0.87) were measured with the Questionnaire on the Experience and Evaluation of Work [(10)]. Survey participants responded on a five-point frequency scale ranging from 'never' (=1) to 'always' (=5) and item scores were summed to a total subscale score, which was then divided by the number of items in the scale. Consequently, all psychosocial work characteristics had a score range between 1 (=low) and 5 (= high).

Social support from family and friends was assessed with 3 items (Can you count on the support of partner/family/friends when you have some difficulty at work? Is work at home taken out of your hands if you are busier at work? Do you feel appreciated by your partner/family/friends?; α=0.78). Survey participants responded on a five-point frequency scale ranging from 'never' (=1) to 'always' (=5) and item scores were summed and averaged so that social support from family/friends ranged between 1 (=low) and 5 (= high).

Work satisfaction was measured with 6 items (α=0.91) about pleasure in work (e.g., I am pleased to start my day's work; I find my work stimulating; I enjoy my work). Responses were given on 5-point frequency scales ranging from 'never' (=1) to 'always' (=5). Items scores were summed and averaged, so that work satisfaction ranged between 1 (=low) and 5 (=high).

Distress was measured with the Four-Dimensional Symptom Questionnaire (4DSQ), which was included in the occupational health survey questionnaire. The distress scale consisted of 16 items addressing symptoms elicited by stressors or the efforts to maintain psychosocial functioning, such as worry, irritability, tension, listlessness, poor concentration, sleeping problems and demoralization [(11)]. Survey participants were asked if they experienced these symptoms in the past week, 'no' (=0), 'sometimes' (=1), 'regularly' (=2), 'often' (=2), or 'very often/constantly' (=2). Item scores were summed (score range 0–32; Cronbach's α=0.94) so that higher scores reflected higher levels of distress. Terluin et al. [(12)] defined scores ≤10 as low, 11-20 as moderate, and >20 as high distress.

Statistical analysis

Statistical analyses were done in IBM SPSS Statistics for Windows, version 24 (released 2016; IBM Corp. Armonk, NY).

Missing data

Of the 1,736 occupational health survey participants, 116 (7%) had missing data on role clarity and social support from family/friends. The missing data were imputed in SPSS by using series means. Marital status was not available from the occupational health survey questionnaire and was therefore excluded from the prediction model.

External validation of the regression model

The regression coefficients of gender, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress from the development setting were combined with the predictor values of the validation setting. As all workers were employed in mobility services, the economic sector was a constant.

External validation of the decision tree

The decision tree was based on the development study. According to the development study, work satisfaction was dichotomized into low (≤ 3.3) and high (> 3.3). Likewise, work pace was dichotomized into low (≤ 3.8) and high (> 3.8).

Discrimination by regression model and decision tree

Discrimination between participants with and without mental LTSA during follow-up was evaluated by receiver operating characteristic curve (ROC) analysis, using the probabilities estimated by the prediction model and the decision tree. The area under the ROC-curve (AUC) represents discrimination between workers with and without mental LTSA during follow-up. AUC<0.60 represents failing, 0.60–0.69 poor, 0.70–0.79 fair, 0.80–0.89 good, and 0.90–1.00 perfect discrimination. The AUCs were compared by using the non-parametric Wilcoxon statistic according to Hanley and McNeil [(13)].

For the decision tree, risk groups were defined according to the development study. For the regression model, cut-off points set at 0.5, 1.0, 1.5, and 2.0 times the population mental LTSA risk were examined in more detail.

Results

The 1,736 occupational health survey participants had a mean age of 46.1 (standard deviation [SD] = 10.1) years; they worked on average 36.4 (SD = 7.3) hours per week as technicians (50%), office workers (43%), or shop assistants (7%). Table 1 shows the scores on the predictor variables of workers with and without mental LTSA during 1-year follow-up. Workers with mental LTSA had lower scores on learning opportunities, support from co-workers, support from family/friends and work satisfaction.

Table 1 Population characteristics of occupational health survey participants (n=1,736).

	Mental LTSA[a] (n=51)				**No mental LTSA**[a] (n=1,685)				**Analysis**
	Mean	SD[b]	n	%	Mean	SD[b]	n	%	
Sociodemographic variables									
Gender									P = 0.18[c]
men			29	57			1,121	66	
women			22	43			564	34	
Years employed at company	16.9	9.5			15.3	10.7			P = 0.13[c]
Psychosocial work factors (range 1-5)									
work pace	2.7	0.8			2.7	0.8			P = 0.62[e]
cognitive demands	3.5	0.7			3.6	0.8			P = 0.36[e]
role clarity	3.7	0.7			3.8	0.7			P = 0.26[e]
learning opportunities	2.7	1.1			3.0	0.9			P = 0.03[e]
support co-workers	3.4	0.9			3.9	0.8			P = 0.00[e]
Social support family/friends (range 1-5)	3.3	1.1			3.6	1.0			P = 0.01[e]
Work satisfaction (range 1-5)	3.7	0.8			4.0	0.8			P = 0.00[e]
Distress									P = 0.00[d]
low			20	39			1,183	70	
medium			21	41			378	22	
high			10	20			124	8	

[a] long-term sickness absence due to mental disorders
[b] standard deviation
[c] Chi-square test
[d] non-parametric Mann-Whitney U-test
[e] parametric Student's t-test

Validation of the prediction model

The regression model fairly discriminated (AUC=0.700; 95% CI 0.628–0.773) between participants with and without mental LTSA during follow-up. This implicates that for each random pair of participants, the prediction model correctly assigned the highest risk to the participant with mental LTSA during follow-up in 70.0% of the cases.

At a cut-off risk 0.5 times population risk, most participants (n=47) with mental LTSA would be identified, at the cost of inviting 76% of all survey participants to preventive consultations (Table 2). At a cut-off risk 1.5 times the population risk, 17% of all survey participants would be invited for preventive consultations, but only 20 of 51 participants with mental LTSA would be identified.

Table 2 Cut-off points for risk of mental LTSA.
The table shows the number of occupational health survey participants at risk, as well as the number of true and fasle positives, sensitivity, specificity and (positive and negative) predictive values at cut-off risks 0.015 (half time population risk), 0.030 (population risk), 0.045 (1.5 times population risk) and 0.060 (2 times population risk).

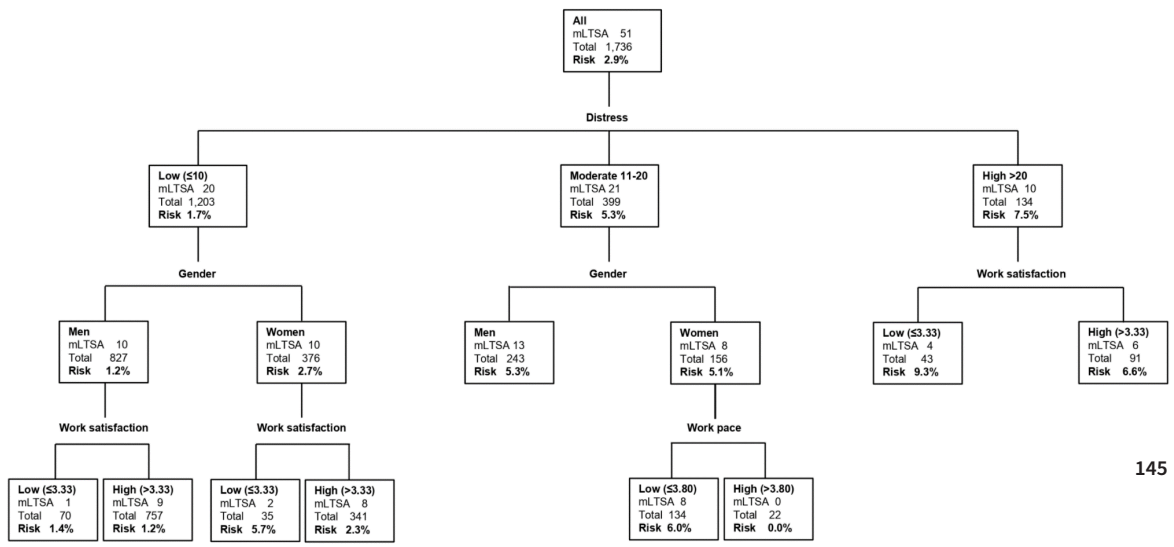
Cut-off risk	Number [a]	% [a]	TP [b]	FP [c]	Sens[d]	Spec[e]	PPV [f]	NPV [g]
0.015	1,316	76	47	1,269	0.92	0.25	0.06	0.99
0.030	583	34	33	550	0.65	0.67	0.06	0.98
0.045	301	17	20	281	0.39	0.83	0.06	0.98
0.060	161	9	13	148	0.25	0.91	0.08	0.98

[a] number (%) of participants above cut-off risk
[b] number of true positives
[c] number of false positives
[d] sensitivity
[e] specificity
[f] positive predictive value
[g] negative predictive value

Validation of the decision tree

The decision tree correctly assigned the highest risk of mental LTSA in 67.1% of the cases (AUC=0.671; 95% CI 0.589–0.753). Although lower, the AUC did not differ significantly (p=0.62) from that of the regression model. Survey participants with low, moderate and high distress scores had a 1.7%, 5.3% and 7.5% mental LTSA risk, respectively (Figure 1). Among survey participants reporting low distress, there was no substantial gender difference in mental LTSA risk. Among women experiencing moderate distress, those reporting low work pace had a higher mental LTSA risk than those reporting high work pace.

Figure 1 Decision tree (n=1,736).



Discussion

The present study externally validated the ability of a previously developed prediction model and decision tree to discriminate between participants with and without mental LTSA in the year following an occupational health survey. Although decision trees depend on the data in which they were developed [8], the present study showed that discrimination by the decision tree did not differ significantly from discrimination by the prediction model.

The prediction model did not have an optimal cut-off risk to invite participants to preventive consultations. The decision tree readily defines the risk groups and consequently it is easier to use the decision tree to identify participants for preventive consultations. However, despite the 'pruning' in the development study, the decision tree was not stable. For example, women reporting moderate distress and low work pace had the highest risk of mental LTSA, whereas in the development study those with high work pace had the highest mental LTSA risk (van Hoffen et al 2019). It should be noted that in the present study the number of women reporting high work pace was limited (n=22). Furthermore, if the decision tree was re-estimated work pace would not be a splitting factor. Only distress and work satisfaction would split the present population into risk groups [data not shown].

Strengths and weaknesses of the study

External validation studies are necessary to evaluate the generalization of risk predictions by prediction models and decision trees. The use of a new sample of occupational health survey participants is an asset of the present study, since it provides insight whether predictions hold true in subjects working in a different setting and in a different time frame [14]. Split-sample analysis would include part of the same study population in the same time frame. The prospective design and the use of recorded OP-certified mental LTSA are further strengths of the study.

A limitation of the present study was that marital status was not available from the occupational health survey questionnaire. Consequently, it was not possible to externally validate the original 11-predictor regression model. Marital status was the least strong predictor in the development study [6] and therefore it is unlikely that excluding marital status as predictor variable has substantially weakened the quality of the prediction model. The AUCs of the validated prediction model (AUC=0.700) and decision tree (AUC=0.671) were lower, but of the same magnitude as those in the development study (AUC=0.713 and AUC=0.709, respectively). Although the prediction model and decision tree were internally validated at development, the poorer discrimination might still be indicative of over-optimistic predictions in the development study. Poorer discrimination may also have been caused by the fact that all participants in the present study worked in the same economic sector.

Practical implications

The prediction model and the decision tree equally well discriminated between occupational health survey participants with and without mental LTSA during 1-year follow-up. Decision trees are easier to interpret and readily show the mental LTSA risk groups. Based on the present results, participants reporting moderate (n=399) or high (n=134) distress (i.e., 23% of the total group of participants) could be invited for preventive consultations, potentially preventing 31 (61%) of 51 mental LTSA cases. A comparable result would be achieved by using the prediction model to invite those 583 participants with a mental LTSA risk higher than the population risk, identifying 33 of 51 mental LTSA cases.

The positive predictive value of the prediction model is low (6%), due to the low a priori risk of mental LTSA (3%). The question arises whether it is efficient to consult with 23% of occupational health survey participants when only 6% of them develop mental LTSA. It should be reminded, however, that occupational health surveys are not conducted to screen for mental LTSA. The surveys address the workers' health status and working conditions. In practice, it is almost always feasible to consult with a quarter of all occupational health survey participants. It makes sense to invite those participants with elevated mental LTSA risk (prediction model) or elevated distress levels (decision tree), particularly in organisations where there are psychosocial work environment issues. The preventive consultation can be used to explore in more detail how workers experience the psychosocial work environment. Even if the individual workers do not develop mental LTSA, their information is valuable to advise accommodations at the departmental level to improve the psychosocial work environment.

We conclude that both the prediction model and the decision tree can be used to identify participants for preventive consultations when the population risk of mental LTSA is known. In situations where the population risk of mental LTSA is unknown, we recommend using the decision tree to identify occupational health survey participants at risk of mental LTSA and invite them to preventive consultations.

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Chapter 10

General discussion

This thesis aimed to generate knowledge on the prediction of long-term sickness absence (LTSA) due to mental disorders. The first objective of this thesis was to predict the risk of mental LTSA in non-sicklisted workers participating in occupational health surveys. The second objective was to increase the understanding of the causal pathways of psychosocial working conditions, work satisfaction, work ability and health outcomes in terms of distress, burnout and engagement leading to mental LTSA by using mediation analyses. Thirdly, we developed and validated a prediction model for risk of mental LTSA by using logistic regression analysis and decision tree analysis. This general discussion will first present our main findings followed by some methodological considerations and implications for occupational health practice.

Summary of main findings

Mental LTSA risk predictions in non-sicklisted workers.

Chapter 2 describes the predictive role of the Maslach Burnout Inventory – General Survey (MBI–GS) and Utrecht Work Engagement Scale (UWES) for mental LTSA. In a one-year prospective cohort study including 4,921 employees participating in occupational health surveys in the period 2008–2010, MBI—GS and UWES scores were associated with LTSA retrieved from an occupational health register at 1-year follow-up. Associations were stratified by LTSA cause (mental, musculoskeletal, and other somatic illness). MBI—GS scores were positively and UWES scores negatively associated with mental LTSA, but not musculoskeletal or other somatic LTSA. Discrimination between employees at high and low risk of mental LTSA was moderate for the MBI–GS (AUC = 0.68; 95 % CI 0.58 to 0.78) as well as the UWES (AUC = 0.70; 95 % CI 0.62 to 0.79). Discrimination did not improve when the MBI—GS and UWES were used simultaneously. It was concluded that the MBI—GS and UWES predicted future mental LTSA in non-sicklisted employees, but discrimination was not practically useful though both instruments could be used to select employees for further assessment of mental LTSA risk.

The ability of mental health symptoms to identify workers at risk of mental LTSA was investigated in a prospective cohort study of 4,877 non-sicklisted workers in distribution and transport **(chapter 3)**. Mental health symptoms were measured at baseline in November 2010 with the 4-DSQ (distress and depressed mood) and MBI–GS (fatigue). The symptom scores were analyzed against incident mental LTSA retrieved from an occupational health register in 2011 and 2012. Distress fairly (AUC=0.75; 95 % CI 0.67 to 0.82) discriminated between workers with and without mental LTSA, whereas the discriminative ability of both depressed mood (AUC=0.64; 0.57 to 0.72) and fatigue (AUC=0.61; 0.53 to 0.69) was poor. It was concluded that the 4-DSQ distress scale may be a promising tool to screen working populations for mental LTSA.

In **chapter 4** the discrimination by the 16-item 4-DSQ distress scale was compared with discrimination by a distress screener with items on worrying, listlessness, and feeling tense, derived from the full 16-item distress scale. Discrimination between non-sicklisted workers with and without mental LTSA was found to be similar for the 16-item distress scale (AUC = 0.721; 0.622 to 0.823) and the three-item screener (AUC = 0.715; 0.615 to 0.815). Thus, it is more convenient for healthcare providers to use the three key questions of the 16-item 4-DSQ distress scale to identify non-sicklisted employees at risk of future mental SA.

In **chapter 5** psychosocial job demands and job resources were investigated for their predictions of mental LTSA among nurses, by using Cox regression analysis. The data of 2059 nurses were obtained from the Norwegian survey of Shift work, Sleep and Health. Job demands (psychological demands, role conflict, and harassment at the workplace) and job resources (social support at work, role clarity, and fair leadership) were measured at baseline and linked to mental LTSA during 2-year follow-up. Harassment (HR = 1.07; 1.01 to 1.17) and social support (HR = 0.92; 0.87 to 0.98) were associated with mental LTSA, but the Cox regression model did not discriminate between nurses with and without mental LTSA (c = 0.59; 0.53 to 0.65). It was concluded that psychosocial job demands and resources failed to discriminate between nurses with and without mental LTSA during 2-year follow-up.

Chapter 6 describes predictions of mental LTSA by psychosocial job demands (workload, work pace) and job resources (variety in work, performance feedback, social support at work), using logistic regression analysis. In a cohort study including 4,877 workers employed in the distribution and transport sector in The Netherlands, only performance feedback was associated with mental LTSA (OR=0.82; 0.70 to 0.96), i.e., lack of performance feedback increased the mental LTSA risk. Job demands and the other job resources were not significantly associated with the risk of mental LTSA. A prediction model including psychosocial work characteristics poorly discriminated. (AUC=0.65; 0.56 to 0.74) between workers with and without mental LTSA.

Increasing the understanding of the causal mechanisms of mental LTSA.
In previous research, distress was found to be the most important predictor for mental LTSA. Adding psychosocial work characteristics to a prediction model with distress hardly improved the model's discriminative ability. Possibly, the effect of psychosocial job demands and resources is mediated by distress. In other words: adverse psychosocial working conditions might lead to distress and sustained distress consequently leads to mental LTSA. **Chapter 7** investigates the mediational effect of distress, burnout, work satisfaction, engagement, and work ability for the relation between psychosocial working conditions and mental health-related LTSA. First, the effects of the psychosocial working conditions on mental LTSA were assessed using univariable and multivariable logistic regression analyses. Second, to assess the mutual influences of the psychosocial working conditions, i.e., job demands and job resources, a multivariable logistic regression model was used in which the relationships between all job demands and job resources and mental LTSA were analyzed simultaneously. The mediation analyses were performed by using structural equation modeling. Role clarity, cognitive demands, emotional demands, work variety, learning opportunities, social support from colleagues, and social support from family and friends were related to mental LTSA after adjustment for other working conditions. Emotional demands had the strongest direct effect on mental LTSA (OR 1.304; 95 % CI 1.135 to 1.498). The relation between psychosocial working conditions and mental LTSA was mediated by distress, work satisfaction, and work ability. Distress was the most important mediator between psychosocial working conditions and mental LTSA. This might well explain why predictions of a model including distress as a predictor for risk of mental LTSA do not improve by adding psychosocial working conditions.

Development and validation of prediction models for risk of mental LTSA by using logistic regression analysis and decision tree analysis.
Distress together with other occupational health survey variables was used to develop a multivariable prediction model for mental LTSA in **chapter 8**. Mental LTSA predictions in 53,833 non-sicklisted participants in occupational health surveys between 2010 and 2013 were addressed by using two techniques: logistic regression analysis and decision tree analysis (DTA). An 11-predictor logistic regression model (gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress) discriminated between workers with and without mental LTSA during 1-year follow-up (AUC = 0.713; 0.699 to 0.732). A 3-node decision tree (distress, gender, work satisfaction, and workpace) equally well discriminated between participants with and without mental LTSA at follow-up (AUC = 0.709; 95% CI 0.615–0.804). The decision tree provides better insight into the mental LTSA risk groups and is easier to use in occupational health care practice.

The logistic regression and decision tree prediction models were externally validated in the data of a cohort of 3,415 non-sicklisted workers in mobility services who participated in occupational health surveys in 2016 **(chapter 9)**. The logistic regression model fairly discriminated (AUC=0.700; 95% CI 0.628 – 0.773) between participants with and without mental LTSA during follow-up. Discrimination by the decision tree was comparable (AUC=0.671; 95% CI 0.589 – 0.753). We recommend to use the decision tree based on distress, gender and work satisfaction in preventive consultations following occupational health surveys.

Reflections on the main findings

In previous studies the association between mental complaints and all-cause LTSA has been described [1-3]. Literature on the relation between mental complaints and mental LTSA as well as predictive studies are very rare [4-6]. By developing prediction models for mental LTSA we aimed to generate knowledge of predictors of mental LTSA. Prediction models identify employees at high risk to develop a disease and are based on data containing potential predictors and sick leave data. We found that the 4-DSQ distress scale is a promising tool to screen working populations for the risk of mental LTSA (Chapter 3). Healthcare providers could use the three-item distress screener derived from the 4-DSQ distress scale to identify non-sicklisted employees at risk of future mental SA (Chapter 4).

Psychosocial working conditions and mental LTSA

Besides mental complaints, psychosocial working conditions have been described to be associated with mental LTSA [7,8]. We found that emotional demands had the strongest effect on mental LTSA. This is in line with previous research in which emotional demands were found to be predictive of all-cause LTSA in a cohort study of 26.410 Danish workers [9]. Aronsson et al [10] found that human service occupations had a higher risk of sickness absence compared to other occupations particularly because of the high emotional demands and workplace violence. Slany [11] on the other hand found no association between high emotional demands and sickness absence. A possible explanation for the different results could be that the surveys used different questionnaires to measure emotional demands. Furthermore, associations of job demands and resources may vary across working populations and workplace settings [12]. Education and healthcare are the sectors with the highest reported mental LTSA [13]. This is commonly explained by the high perceived work pace. According to our findings this is presumably due to emotional demands and harassment in these branches rather than high work pace [13].

Although many studies [14-16] reported a solid relationship between work pace and mental LTSA, we found no association between these two factors. There is no broadly accepted and consistent definition of work pace.

We found no association between social support from supervisor and mental LTSA even though several studies [17,18] found an association between the two. In our study role clarity, cognitive demands, emotional demands, work variety, learning opportunities, social support from colleagues, and social support from family and friends were related to mental LTSA after adjustment for other working conditions. Periodic occupational health surveys should therefore include those psychosocial working conditions.

Job demands and job resources were not significantly associated with the risk of mental LTSA for individual workers. It was therefore concluded that it is not useful to measure psychosocial work characteristics to identify workers at risk of mental LTSA.

Causal Mechanisms of mental LTSA

In our previous research we found that distress is the most important predictor for mental LTSA. Including psychosocial work characteristics in a prediction model with distress hardly improved the discriminative value of the prediction model. Our study is based on the Job Demands-Resources (JD-R) model which describes that adverse psychosocial working conditions, such as job demands lead to emotional exhaustion and burnout if the efforts to meet job demands are too high or if there is insufficient time to recover from the demands, i.e. the exhaustion process [19]. On the other hand, high job resources help to cope with the job demands, achieve goals, stimulate personal growth and lead to work satisfaction. i.e. the motivational process [19,20]. We hypothesized that distress is a mediator in the exhaustion process, while work satisfaction and work ability are mediating factors in the motivational processes [21]. To our knowledge this is the first time those factors are investigated together in a mediation analysis.

Distress indeed mediated between psychosocial working conditions and mental LTSA. This may explain why adding psychosocial working conditions to a prediction model including distress did not improve the predictive value. According to the JD-R model high job demands lead to distress, through the exhaustion process [22], which in turn leads to mental health-related LTSA. In chapter 7 we found that high emotional demands and high work-family interference lead to mental health-related LTSA. Both effects were mediated by distress.

Furthermore we found that work satisfaction and work ability mediated the effect of role clarity, learning opportunities, and variety in work on mental health-related LTSA. This indicates that work satisfaction and work ability play an important role in the motivational process through which psychosocial working conditions operate.

Development and validation of the prediction models

After researching the predictive value of mental complaints and psychosocial working conditions separately, we combined them and developed a multivariable 11-predictor regression model (gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress) and a 3-node decision tree (distress, gender and work satisfaction) in chapter 8. The prediction model and the decision tree equally well identified workers at risk of mental LTSA. However, at external validation we found reduced discriminative ability, and both the prediction model and the decision tree poorly discriminated between non-sicklisted workers with and without mental LTSA. According to Steyerberg validation studies are expected to find reduced discriminative ability [23]. The reduction of discriminative ability was the same in both the prediction model and the decision tree. Therefore it is advised to use the decision tree for is it easier to use in occupational health care practice.

The positive predictive value of the prediction model is low (6%), due to the low a priori risk of mental LTSA (1,5 a 3%). The question arises whether it is efficient to consult with 23% of occupational health survey participants when only 6% of them develop mental LTSA.

It should be reminded, however, that occupational health surveys are conducted to address the workers' health status and working conditions and not to screen for mental LTSA. In practice, it is almost always achievable to consult with a quarter of all occupational health survey participants. Particularly in organizations with psychosocial environment issues it makes sense to invite those participants with elevated mental LTSA risk (prediction model) or elevated distress levels (decision tree), environment issues. The preventive consultation can be used to explore in more detail how workers experience the psychosocial work

environment. The decision tree, based on distress, gender, and work satisfaction could be used in preventive consultations to explore mental LTSA risk factors in more detail. Even if the individual workers do not develop mental LTSA, their information is valuable to advise modifications at the departmental level to improve the psychosocial work environment.

Methodological considerations

The strengths of the studies in this thesis are the prospective designs, the use of different statistical methods, and the use of recorded LTSA data retrieved from an OHS sickness absence register. Recorded sickness absence data are more reliable than employee-reported data. Furthermore, the studies used OP diagnoses, which are more reliable than self-reported mental illnesses.

The study populations, however, were not representative of the general work force. Furthermore, we had to deal with large proportions (41 to 49 %) of missing data. The occupational health questionnaires consisted of different modules in the various populations. In the analyses, missing data were not random. This makes sense, because the content of occupational health surveys is determined by employers and employee representatives, not by chance. Missing data with a not (completely) random distribution cannot be imputed. Therefore, we had to exclude participants in occupational health surveys with missing data, which limits the generalization of our findings to the total workforce.

Another limitation of our studies was potential diagnostic misclassification. LTSA due to symptoms such as pain and stiffness in combination with sleep problems and tiredness may have been classified as musculoskeletal LTSA, although these symptoms might also be indicative of (co-morbid) mental disorders. Physical illness has been reported to be more common in employees with burnout than in those without burnout [24,25]. OPs could only certify LTSA with one ICD-10 diagnosis, while many studies have reported comorbidity between musculoskeletal and mental disorders [26,27].

A further limitation is that the data were collected within the context of daily occupational healthcare practice. Therefore, it was not possible to predefine predictor variables or include predictor variables which are not commonly used in occupational healthcare practice. Most predictor variables were measured with the Questionnaire on the Experience and Evaluation of Work (28), which is a valid instrument for assessing psychosocial working conditions. However, routinely collected data can miss important information because the data is not collected for specific research aims. Although convenient, a major disadvantage of measuring psychosocial working conditions with self-administered questionnaires is that workers' responses are not only affected by psychosocial working conditions, but also by other factors, such as mood, expectations, previous experiences, or health [8]. Such personal dispositions might have caused under- and overestimations of associations between psychosocial working conditions and mental LTSA.

Implications for occupational health practice

A multivariable 11-predictor regression model (gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress) and a 3-node decision tree (distress, gender and work satisfaction) were predictive of mental LTSA during 1-year follow-up. However, the discriminative ability of the 11-predictor model and the 3-node decision tree was not sufficient to distinguish between workers with and without mental LTSA. The prevalence of mental LTSA in the working population varies between 1.5 and 3%, which is probably too low to achieve a substantial positive predictive value. Our studies showed a considerable number of false positives (i.e., workers identified as high-risk but without mental LTSA at follow-up). False positive results may lead to unnecessary fear, medicalization, and even stigmatization. Therefore, we advise against screening working populations for risk of mental LTSA by using the prediction model or decision tree, developed in this PhD study. The 11-predictor model or the 3-node decision tree could be used to further explore mental LTSA risk factors in preventive consultations [29]. Burdorf [30] pleaded to use prediction models for identifying risk factors rather than screening working populations.

The decision tree is particularly practical because it readily identifies risk groups. During a preventive consultation the occupational health professional can explore the causes of distress, low satisfaction, and poor work ability. If necessary employees could be referred to an occupational social worker or psychologist to prevent mental LTSA.

Since the effect of emotional demands on mental LTSA was found to be the strongest, it is important to teach workers by means of a preventive training to regulate their emotions on a daily basis [31] and give them time to recover during work in jobs with high emotional demands [32].

Employees with cognitive and emotional demands are advised to be stimulated to take mini brakes to buffer stress during the work day [33,34]. Occupational health services could train supervisors to recognize early signs of distress, burnout, dissatisfaction, low engagement and low work ability in their employees [35]. A training program for supervisors could lead to a significant reduction in work-related sickness absence [36].

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Summary

Chapter 1 introduces the context and importance of our topic. Mental disorders are the leading cause of sickness absence and disability pensions in European countries. The amount of workers with long term sickness absence due to mental disorders has increased over the past decade and is still increasing. We need more knowledge of predictors of mental sickness absence to identify those workers at high risk of mental long-term sickness absence (LTSA) before they report sick. In this thesis, prediction models for mental LTSA will be developed and validated using variables that are commonly addressed in occupational health surveys. This thesis also investigates causal mechanisms of mental long-term sickness absence.

Chapter 2 describes the predictive performance of the Maslach Burnout Inventory (MBI-GS) and Utrecht Work Engagement Scale (UWES) for identifying workers at increased risk of mental LTSA. In a one-year prospective cohort study including 4,921 employees participating in occupational health surveys in the period 2008–2010, MBI—GS and UWES scores were associated with LTSA retrieved from an occupational health register at 1-year follow-up. Associations were stratified by LTSA cause (mental, musculoskeletal, and other somatic illness). MBI—GS scores were positively and UWES scores negatively associated with mental LTSA, but not musculoskeletal or other somatic LTSA. Discrimination between employees at high and low risk of mental LTSA was moderate for the MBI–GS (AUC = 0.68; 95 % CI 0.58 to 0.78) as well as the UWES (AUC = 0.70; 95 % CI 0.62 to 0.79). Discrimination did not improve when the MBI—GS and UWES were used simultaneously. It was concluded that the MBI—GS and UWES predicted future mental LTSA in non-sicklisted employees, but discrimination was not practically useful though both instruments could be used to select employees for further assessment of mental LTSA risk.

Chapter 3 investigates the ability of mental health symptoms to identify workers at risk of mental LTSA in a prospective cohort study of 4,877 non-sicklisted workers in distribution and transport. Mental health symptoms were measured at baseline in November 2010 with the 4-DSQ (distress and depressed mood) and MBI–GS (fatigue). The symptom scores were analyzed against incident mental LTSA retrieved from an occupational health register in 2011 and 2012. Distress fairly (AUC=0.75; 95 % CI 0.67 to 0.82) discriminated between workers with and without mental LTSA, whereas the discriminative ability of both depressed mood (AUC=0.64; 0.57 to 0.72) and fatigue (AUC=0.61; 0.53 to 0.69) was poor. It was concluded that the 4-DSQ distress scale may be a promising tool to screen working populations for mental LTSA.

Chapter 4 compares the discrimination by the 16-item 4-DSQ distress scale with discrimination by a distress screener with items on worrying, listlessness, and feeling tense, derived from the full 16-item distress scale. Discrimination between non-sicklisted workers with and without mental LTSA was found to be similar for the 16-item distress scale (AUC = 0.721; 0.622 to 0.823) and the three-item screener (AUC = 0.715; 0.615 to 0.815). Thus, it is more convenient for healthcare providers to use the three key questions of the 16-item 4-DSQ distress scale to identify non-sicklisted employees at risk of future mental SA.

Chapter 5 investigates psychosocial job demands and job resources for their predictions of mental LTSA among nurses, by using Cox regression analysis. The data of 2059 nurses were obtained from the Norwegian survey of Shift work, Sleep and Health. Job demands (psychological demands, role conflict, and harassment at the workplace) and job resources (social support at work, role clarity, and fair leadership) were measured at baseline and linked to mental LTSA during 2-year follow-up. Harassment (HR = 1.07; 1.01 to 1.17) and social support (HR = 0.92; 0.87 to 0.98) were associated with mental LTSA, but the Cox regression model did not discriminate between nurses with and without mental LTSA (c = 0.59; 0.53 to 0.65). It was concluded that psychosocial job demands and resources failed to discriminate between nurses with and without mental LTSA during 2-year follow-up.

Chapter 6 describes predictions of mental LTSA by psychosocial job demands (workload, work pace) and job resources (variety in work, performance feedback, social support at work), using logistic regression analysis. In a cohort study including 4,877 workers employed in the distribution and transport sector in The Netherlands, only performance feedback was associated with mental LTSA (OR=0.82; 0.70 to 0.96), i.e., lack of performance feedback increased the mental LTSA risk. Job demands and the other job resources were not significantly associated with the risk of mental LTSA. A prediction model including psychosocial work characteristics poorly discriminated. (AUC=0.65; 0.56 to 0.74) between workers with and without mental LTSA.

Chapter 7 investigates the mediational effect of distress, burnout, work satisfaction, engagement, and work ability for the relation between psychosocial working conditions and mental health-related LTSA. First, the effects of the psychosocial working conditions on mental LTSA were assessed using univariable and multivariable logistic regression analyses. Second, to assess the mutual influences of the psychosocial working conditions, i.e., job demands and job resources, a multivariable logistic regression model was used in which the relationships between all job demands and job resources and mental LTSA were analyzed simultaneously. The mediation analyses were performed by using structural equation modeling. Role clarity, cognitive demands, emotional demands, work variety, learning opportunities, social support from colleagues, and social support from family and friends were related to mental LTSA after adjustment for other working conditions. Emotional demands had the strongest direct effect on mental LTSA (OR 1.304; 95 % CI 1.135 to 1.498). The relation between psychosocial working conditions and mental LTSA was mediated by distress, work satisfaction, and work ability. Distress was the most important mediator between psychosocial working conditions and mental LTSA. This might well explain why predictions of a model including distress as a predictor for risk of mental LTSA do not improve by adding psychosocial working conditions.

Chapter 8 presents the development of a multivariable prediction model for mental LTSA using distress together with other occupational health survey variables. Mental LTSA predictions in 53,833 non-sicklisted participants in occupational health surveys between 2010 and 2013 were addressed by using two techniques: logistic regression analysis and decision tree analysis (DTA). An 11-predictor logistic regression model (gender, marital status, economic sector, years employed at the company, role clarity, cognitive demands, learning opportunities, co-worker support, social support from family/friends, work satisfaction, and distress) discriminated between workers with and without mental LTSA during 1-year follow-up (AUC = 0.713; 0.699 to 0.732). A 3-node decision tree (distress, gender, work satisfaction, and workpace) equally well discriminated between participants with and without mental LTSA at follow-up (AUC = 0.709; 95% CI 0.615–0.804). The decision tree provides better insight into the mental LTSA risk groups and is easier to use in occupational health care practice.

Chapter 9 describes the external validation of the logistic regression and decision tree prediction models in the data of a cohort of 3,415 non-sicklisted workers in mobility services

who participated in occupational health surveys in 2016. The logistic regression model fairly discriminated (AUC=0.700; 95% CI 0.628 – 0.773) between participants with and without mental LTSA during follow-up. Discrimination by the decision tree was comparable (AUC=0.671; 95% CI 0.589 – 0.753). We recommend to use the decision tree based on distress, gender and work satisfaction in preventive consultations following occupational health surveys.

Samenvatting

Hoofdstuk 1 introduceert de context en het belang van het onderwerp. Psychische stoornissen zijn de belangrijkste oorzaak van ziekteverzuim en arbeidsongeschiktheidsuitkeringen in Europese landen. Het aantal werknemers met langdurig ziekteverzuim ten gevolge van psychische stoornissen is het afgelopen decennium toegenomen en is nog steeds aan het toenemen. Er is behoefte aan meer kennis van voorspellers van psychische stoornissen zodat medewerkers, die risico lopen om langdurig arbeidsongeschikt te worden door psychische stoornissen, geïdentifceerd kunnen worden voordat ze zich ziekmelden. In dit proefschrift zullen predictiemodellen voor landurig verzuim vanwege psychische stoornissen ontwikkeld en gevalideerd worden door gebruik te maken van variabelen, die algemeen gebruikt worden in preventieve medische onderzoeken (PMO). Dit proefschrift onderzoekt ook oorzakelijke mechanismen van langdurig verzuim ten gevolge van psychische stoornissen.

Hoofdstuk 2 beschrijft de voorspellende waarde van de Maslach Burnout Inventory (MBI-GS) en de Utrecht Work Engagement Scale (UWES) om werknemers die een verhoogd risico lopen op langdurig verzuim vanwege een psychische stoornis te indentificeren. In een prospectieve cohort studie van 4.921 deelnemers aan een PMO in de periode 2008-2010, waren de MBI-GS en UWES scores geassocieerd met landurig verzuim ten gevolge van door bedrijfsartsen gediagnosticeerde psychische stoornissen in het daarop volgende jaar. Associaties zijn gestratificeerd per oorzaak van langdurig ziekteverzuim (psychisch, bewegingsapparaat en andere lichamelijke ziekten) MBI—GS scores waren positief en UWES scores negatief geassocieerd met langdurig verzuim vanwege psychische klachten maar niet met langdurig verzuim ten gevolge van klachten van het bewegingsapparaat of overige lichamelijke ziekten. MBI-GS discrimineerde matig tussen werknemers met een hoog en lag risico op verzuim vanwege psychische klachten (AUC = 0.68; 95 % CI 0.58 to 0.78) evenals de UWES (AUC = 0.70; 95 % CI 0.62 to 0.79). De discriminatie verbeterde niet bij gelijktijdig gebruik van de MBI—GS en UWES. Er werd geconcludeerd dat de MBI-GS en UWES toekomstig verzuim vanwege psychische klachten bij werknemers voorspelden, maar dat het gebruik van deze instrumenten niet praktisch toepasbaar was om medewerkers met een hoog risico op landurig verzuim vanwege psychische klachten te indentificeren, vanwege het hoge aanral fout-positieven. Beide instrumenten kunnen wel gebruikt worden als screeningsinstrument om medewerkers te selecteren die uitgenodigd kunnen worden voor een spreekuur om hun risico op langdurig verzuim vanwege psychische klachten nader te onderzoeken.

Hoofdstuk 3 onderzoekt in een prospectieve cohort studie van 4.877 niet ziek gemelde werknemers in distributie en vervoer of psychische symptomen werknemers die risico lopen op verzuim vanwege psychische klachten kunnen indentiiceren. Psychische symptomen werden gemeten met de 4-DKL (distress en depressie) en MBI-GS (vermoeidheid) bij de start van het onderzoek in november 2010. De associatie tussen psychische symptomen en de incidentie van door bedrijfsartsen in 2011 en 2012 gediagnosticeerd langdurig psychisch verzuim. Distress discrimineerde redelijk (AUC=0.75; 95 % CI 0.67 to 0.82) tussen werknemers met en zonder langdurig psychisch verzuim, terwijl de discriminatie van zowel depressieve klachten (AUC=0.64; 0.57 to 0.72) als vermoeidheid (AUC=0.61; 0.53 to 0.69) zwak was. Er werd geconcludeerd dat de distress schaal van de 4-DKL een veelbelovend sreeningsinstrument kan zijn om groepen werknemers te screenen op risico op psychisch verzuim.

Hoofdstuk 4 vergelijkt de discriminatie van de 16-item distress schaal van de 4-DKL met de discriminatie van de 3-item distress screener met de items piekeren, lusteloosheid en gespannenheid. Discriminatie tussen niet ziekgemelde werknemers met en zonder psychisch

verzuim in de 2 jaar erna was vergelikbaar voor de 16-item distress schaal (AUC = 0.721; 0.622 to 0.823) en de 3-item distress screener (AUC = 0.715; 0.615 to 0.815). De 3 sleutel vragen van de distress screener van de distress schaal van de 4-DKL is dus handig te gebruiken door zorgverleners om niet ziek gemelde werknemers die risico lopen op psychisch verzuim te identificeren

Hoofdstuk 5 onderzoekt in hoeverre psychosociale werkstressoren en energiebronnen voorspellend zijn voor langdurg psychisch verzuim bij verpleegkundigen. De gegevens van 2059 Noorse verpleegkundigen van het Noorse onderzoek Shift work, Sleep and Health warden geanaliseerd met Cox regeressie analyse. De werkstressoren (psychologische belasting, rolconflict en intimidatie op het werk) en energiebronnen (sociale steun op het werk, taakduidelijkheid en eerlijk leiderschap) werden bij de start gemeten en gekoppeld aan langdurig verzuim vanwege psychische klachten in de 2 jaar erna. Intimidatie (HR = 1.07; 1.01 to 1.17) and sociale steun (HR = 0.92; 0.87 to 0.98) waren geassocieerd met langdurig verzuim vanwege psychische klachten, maar discrimineerden niet tussen verpleegkundigen met en zonder langdurig verzuim vanwege psychische klachten in de 2 jaar erna , (c = 0.59; 0.53 to 0.65).

Hoofdstuk 6 onderzoekt de voorspellende waarde van werkstressoren (werkhoeveelheid en werktempo) en energiebronnen (werkvariatie, feedback over het functioneren, sociale steun op het werk) voor langdurig psychisch verzuim. In a cohort studie van 4.877 werknemers in de distributie en vervoer in Nederland was alleen feedback over het functioneren geassocieerd met langdurig psychisch verzuim (OR=0.82; 0.70 to 0.96). Gebrek aan feedback over het functioneren verhoogde de kans op langdurig psychisch verzuim. De werkstressoren en de andere energiebronnen waren niet significant geassocieerd met het risico op langdurig psychisch verzuim. Een predictiemodel met psychosociale werk kenmerken discrimineerde zwak (AUC=0.65; 0.56 to 0.74) tussen werknemers met en zonder langdurig psychisch verzuim.

Hoofdstuk 7 onderzoekt het mediatie effect van distress, burnout, werk satisfactie, bevlogenheid en werkvermogen van de relatie tussen psychosociale werkomstandigheden en langdurig psychisch verzuim. Eerst werd het effect van de psychosociale werkomstandigheden op landurig psychisch verzuim onderzocht middels univariabele en multivariabele logistische regressive analyse. Om de wederzijdse invloeden van de psychosociale werkomstandigheden, te weten werkstressoren en energiebronnen, te onderzoeken werd daarna een multivariable regressiemodel gebruikt waarin de relatie tussen alle werkstressoren en energiebronnen en langdurig psychisch verzuim gelijktijdig onderzocht werd. Voor de mediatie analyse werd structural equation modeling gebruikt. Taakduidelijkheid, cognitieve belasting, emotionele belasting, werk variatie, ontwikkelingsmogelijkheden, sociale steun van collega's en sociale steun van familie en vrienden waren, na correctie voor de andere werkomstandigheden, geassocieerd met langdurig psychisch verzuim, Emotionele belasting had het sterkste direct effect op langdurig psychisch verzuim (OR 1.304; 95 % CI 1.135 to 1.498). De relatie tussen psychosociale werkomstandigheden en langdurig psychisch verzuim werd gemedieerd door distress, werk satisfactie en werkvermogen. Distress was de belangrijkste mediator tussen psychosociale werk omstandigheden en langdurig psychisch verzuim. Dit zou kunnen verklaren waarom de voorspellende waarde van een predictiemodel inclusief distress voor langdurig psychisch verzuim niet verbetert door toevoeging van psychosociale werkomstandigheden.

Hoofdstuk 8 presenteert de ontwikkeling van een multivariable predictiemodel voor langdurig verzuim vanwege psychische klachten inclusief distress en andere bedrijfsgeneeskundige vragenlijst variabelen. De gegevens van PMO's tussen 2010 en 2013 van 53.833 niet verzuimende werknemers werden onderzocht met 2 technieken: logistische regressive analyse en beslisboom analyse. Een 11-item logistische regressive predictiemodel (geslacht, burgerlijke staat, economische sector, aantal jaren werkzaam bij het bedrijf, taakduidelijkheid, cognitieve belasting, ontwikkelingsmogelijkheden, sociale steun van collega's, sociale steun van familie en vrienden, werk satisfactie en distress) discrimineerden tussen werknemers met en zonder langdurig psychisch verzuim in het jaar erna (AUC = 0.713; 0.699 to 0.732). Een 3-knooppunt beslisboom (distress, geslacht, werksatisfactie en werkdruk) discrimineerde net zo goed tussen deelnemers met en zonder langdurig psychisch verzuim in het jaar erna (AUC = 0.709; 95% CI 0.615–0.804). De beslisboom geeft een beter inzicht in de groepen die risico lopen op langdurig psychisch verzuim en is gemakkelijker te gebruiken in de bedrijfsgeneeskundige praktijk.

Hoofdstuk 9 beschrijft de externe validatie van het logstische regressie predictiemodel en het beslisboom predictiemodel onderzocht in een cohort van 3.415 niet verzuimende werknemers in de mobiliteits service die deelnamen aan een PMO in 2016. Het logistisch regressiemodel discrimineerde redelijk (AUC=0.700; 95% CI 0.628 – 0.773) tussen deelnemers met en zonder langdurig psychisch verzuim in het jaar erna. De discrimatie door het beslisboom predictiemodel was vergelijkbaar (AUC=0.671; 95% CI 0.589 – 0.753). We adviseren om de beslisboom gebaseerd op distress, geslacht en werk satisfactie te gebruiken in preventieve spreekuren volgend op het PMO.

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About the author

Marieke van Hoffen, born on June 6th in Zwolle, attended secundary school at Carolus Clusius College, after which she studied Medicine in Groningen. During her study she already had a broad interest in the human being behind the illness. After her graduation she started to work as an insurance physician at GAK, GUO and BVG. She finished the insurance medicine education in 1996. Because she became more and more interested in prevention she retrained herself to become an occupational health physician in 2000. From 1997 she worked at Arbodienst West that merged into Arbo Unie. From 2005 until 2008 she worked in a combination function as occupational health physician/work&organization consultant at ING and deepened her knowledge of the Job Demands-Resources Model. From 2010 she is working as an occupational health physician at ArboNed and since 2017 at HumanCapitalCare, where she increasingly focused on the development of psychological complaints which resulted in this dissertation trajectory.

She is coordinating occupational health physician for a few big companies and practical trainer for occupational health physicians in training. In addition to her work as occupational health physician she is a docent thesis supervision at NSPOH.

Over de auteur

Marieke van Hoffen, geboren op 6 juni 1963 in Zwolle, is na haar middelbare school, het Carolus Clusius College, geneeskunde gaan studeren in Groningen. Tijdens haar studie had zij al een brede belangstelling voor de mens achter de ziekte. Na haar afstuderen heeft ze in eerste instantie gewerkt als verzekeringsarts bij het GAK, GUO en de BVG. Ze heeft de opleiding verzekeringsgeneeskunde afgerond in 1996. Omdat haar belangstelling steeds meer bij preventie kwam te liggen heeft zij zich laten omscholen naar bedrijfsarts in 2000. Vanaf 1997 was zij werkzaam bij Arbodienst West die later opging in Arbo Unie. Van 2005 tot 2008 was zij werkzaam in de combinatie functie bedrijfsarts/arbeids&organisatiekundige bj de ING en heeft zij zich steeds meer verdiept in het Job Demands-Resources Model. Vanaf 2010 werkt zij als bedrijfsarts bij ArboNed en sinds 2017 bij HumanCapitalCare, waar zij steeds meer het ontstaan van psychische klachten bestudeerde, hetgeen resulteerde in dit promotietraject.

Zij is coördinerend bedrijfsarts voor een paar grote bedrijven en is praktijkopleider van bedrijfsartsen in opleiding. Naast het werk als bedrijfsarts is zij docent scriptiebegeleiding bij de NSPOH.

Stress and sickness absence

Prediction and causal mechanisms of mental sickness absence

Mental disorders are the leading cause of sickness absence and disability pensions in European countries. Marieke van Hoffen has investigated prediction models for mental sickness absence. This knowledge can help to identify workers at risk of mental sickness absence before they call in sick. Interventions can be deployed on time to prevent sick leave.

This thesis also investigates causal mechanisms of mental long-term sickness absence.
Stress complaints are the strongest predictors for mental sickness absence.

Emotional demands in work have the strongest effect on the development on stress complaints and mental sickness absence.

Marieke van Hoffen is working as an Occupational Health Physician at HumanCapitalCare.

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